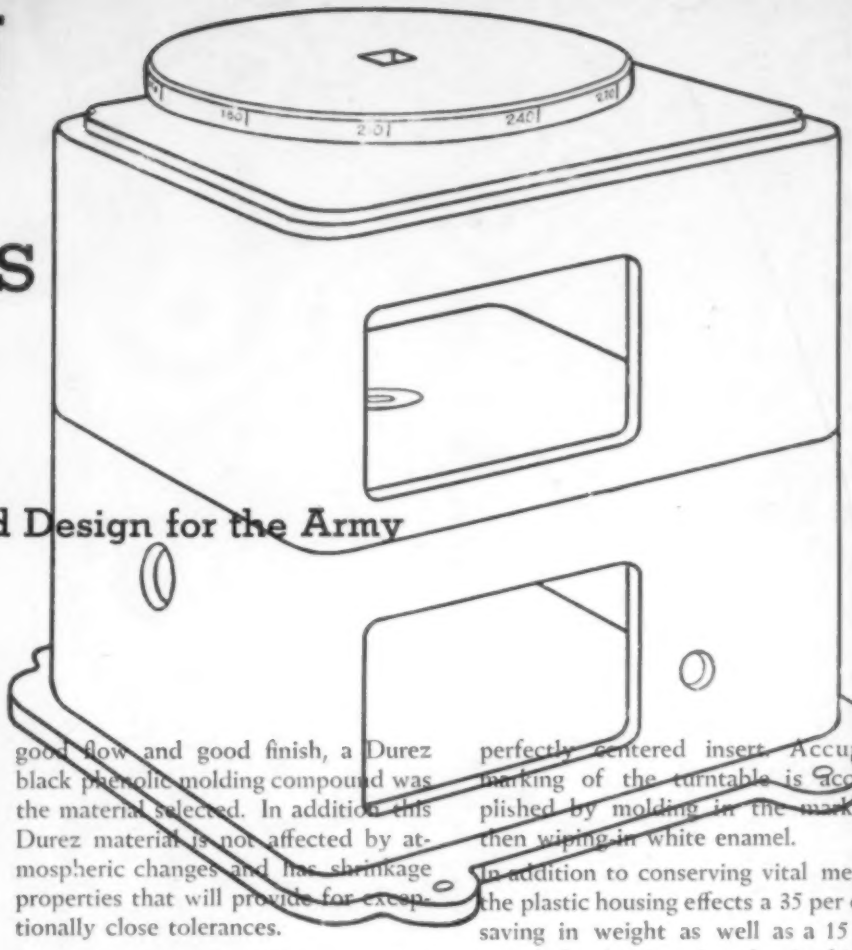
MODERN PLASTICS

JULY 1944

DESIGN DATA ON PLASTICS



VII. An Ingenious Mold Design for the Army

Of interest to designers and engineers is the cooperative spirit and ingenuity of American manufacturers in making every effort to win the war. An excellent example is the production of the aircraft instrument tester for the Army Air Corps. The machine replaces one made wholly of metal and designed many years ago by Army aeronautical engineers for field testing various aircraft instruments such as compasses and bank and turn indicators.

A redesign of the housing and turntable, to permit the use of a plastic instead of vital metals, involved three major problems. These were mold design for the housing, surface tolerance on the turntable and marking the turntable.

Because of its excellent dimensional stability, giving a very rigid set-up, good flow and good finish, a Durez black phenolic molding compound was the material selected. In addition this Durez material is not affected by atmospheric changes and has shrinkage properties that will provide for exceptionally close tolerances.

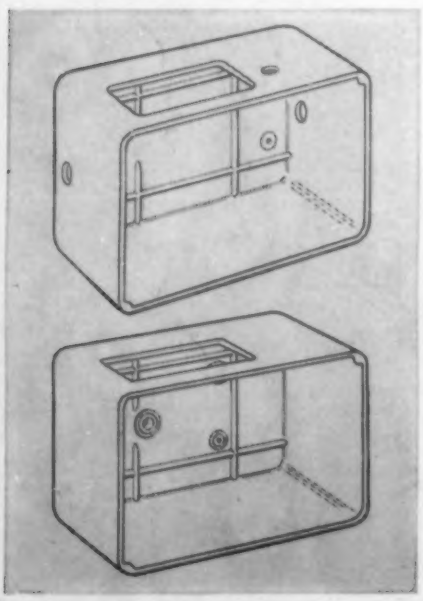
The housing consists of two molds, one for the base plate only, and one for the two halves. The mold for the main body of the housing is an ingenious design since the two halves are duplicates only in overall dimensions. Inserts, guide holes, etc., are different in the top half from those required for the bottom half. By a series of plugs and insert guides it was made practical to mold a quantity of one section, make a temporary mold change, and mold a similar quantity of the other section. By this arrangement a considerable saving in mold cost was effected.

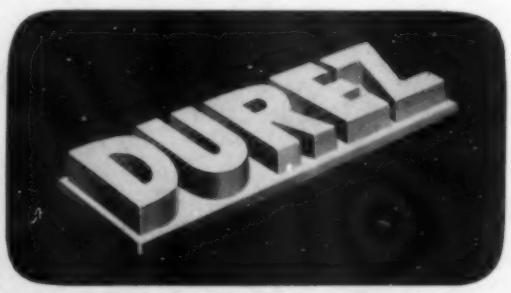
Close tolerances are required for assembly of the housing, for alignment of the interior mechanism and to assure a level surface on the turntable and a perfectly centered insert. Accurate marking of the turntable is accomplished by molding in the markings then wiping in white enamel.

In addition to conserving vital metals, the plastic housing effects a 35 per cent saving in weight as well as a 15 per cent reduction in price, despite higher labor costs.

These Durez plastic-housed instrument testers are giving excellent performance in hottest Africa, the cold of Alaska, in the dryness of the desert and the monsoons of the Pacific. They have been double-checked for accuracy and are functioning to within one-half second in 1080°—three full turns of the table.

Efficient production of this plastic housing is the result of cooperative effort on the part of the manufacturer, molders and material producer. Such teamwork may help solve your design and engineering problems. We offer the facilities and research of our technical staff in determining the "Plastics That Fit The Job". Durez Plastics & Chemicals Inc., 57 Walck Road, N. Tonawanda, N.Y.





PHENOLIC MOLDING COMPOUNDS AND RESINS

PLASTICS THAT FIT THE JOB

Catalin
Catalin is color—gem-like color, rising to its fullest surface expression from bottomless depths.
It is this about Catalin that inspires the jewelry designer. No other material brings him so close to the ruby, emerald, sapphire or topaz. Catalin is exquisite — is imbued with the fire and highlights found only in minerals and semi-precious stones.
And no other material responds so readily to the jeweler's craft. Catalin, in sheets, rods, tubes or custom castings can be machined as easily as brass or wood on ordinary shop equipment.
The tremendous acceptance Catalin and Loalin* have already won in beauty's field is still but a prelude — the real applause is yet to come, and shortly. In that we are certain they can prove helpful, the members of Catalin's staff invite the opportunity to plan now with manufacturers and product designers.
CATALIN CORPORATION · ONE PARK AVENUE, NEW YORK 16, N. Y.
CAST RESINS · *MOLDING COMPOUNDS · LIQUID RESINS
Catalin and Loalin are Registered Trademarks

MODERN PLASTICS

AND PLASTICS

CHARLES A. BRESKIN, *Editor*
DOROTHY MARTIN, *Managing Editor*
DR. GORDON M. KLINE, *Technical Editor*
FRED B. STANLEY, *Engineering Editor*
LAURA E. MORRISON, *Associate Editor*
LOUISE BOYDEN, *Associate Editor*
ELLEN M. LYNN, *Associate Editor*
SHIRLEY SMARR, *Assistant Editor*
R. L. VAN BOSKIRK, *Washington Editor*
HARRIET B. JOSEPHS, *Contributing Editor*
PAUL D. AIRD, *Contributing Editor*
KATHLEEN SKELTON, *Contributing Editor*
DORIS BRIAN, *Contributing Editor*
EDNA SILEN, *Readers' Service*
JOSEPH BOLOGNA, *Art Director*

BUSINESS STAFF

ALAN S. COLE, *General Manager*
P. H. BACKSTROM M. A. OLSEN
DANIEL M. BROADS, *Production*
E. K. LA TOUR, *Circulation*
WALTER S. ROSS, *Promotion*
J. M. CONNORS
221 N. La Salle St., Chicago 1, Ill.
R. C. BEGGS
815 Superior Ave., Cleveland 14, Ohio
L. B. CHAPPELL
427 West 5th St., Los Angeles 13, Calif.

All editorial contents bearing on military subjects have been released for publication by the Armed Services.

MODERN PLASTICS is regularly indexed in the Industrial Arts Index.

Member Audit Bureau of Circulations

EXECUTIVE and EDITORIAL OFFICES: 122 E. 42nd St., New York 17, N. Y. WASHINGTON 6, D. C., OFFICE: 625 Colorado Bldg., 14th & G Sts. Published the 1st of each month by Modern Plastics, Incorporated. Publication Office, Twentieth and Northampton Sts., Easton, Pa. Subscription price $5.00 per year, $8.00 for 2 years in U. S., its possessions and South America. Canadian subscriptions $5.50 per year, $9.00 for 2 years; all other countries $6.00 per year, $10.00 for 2 years, payable in American money or its equivalent. Price 50¢ per copy. Copyright 1944 by Modern Plastics, Inc. All rights reserved. Printed in U. S. A. Entered as second class matter May 28, 1940, at the Post Office at Easton, Pa., under the act of March 3, 1879. Member of the Audit Bureau of Circulations. Back numbers 3 months or more preceding current issues, when available, $1.00 each. Modern Plastics is fully protected by copyright and nothing that appears in it may be reprinted, wholly or in part, without special permission.

VOLUME 21 JULY 1944 NUMBER 11

General Section

Maximum price regulation order 79
High-, low- and no-pressure laminates 80
A new series of thermoplastic resins 83
Better brush work 85
Gun butt for the Browning semi-automatic rifle 86
Acrylic for artificial eyes 88
A new dielectric for cables 90
Outside looking in 96
Low-tension insulating wire 100

Plastics—Engineering Section

Polyfibre—a new approach to molding 101
Injection mold design—Part II 110

Technical Section

Stiffness and brittleness of nonrigid vinyl chloride-acetate resin compounds 119
Effect of environmental conditions on mechanical properties of organic plastics—Part II . . 125
Technical briefs 132
Plastics digest 134
U. S. plastics patents 136

News and Features

Plastics in review 94
Plastics products 98
New machinery and equipment 150
Books and booklets 152
Washington round-up 154
News of the industry 156
Speeches of the month 158

FROM GEON may be made a wide variety of thermoplastic elastomers which can easily be extruded, pressure or injection molded, calendered, cast into sheet and film, or used as coatings for fabric and paper.

The following properties in innumerable combinations may be found in products of GEON:

- Flexible
- Waterproof
- Light weight
- High tensile strength
- Easily embossed
- Wide range of colors and luster
- Electrical insulation
- Odorless
- Wide hardness range

Resistance to

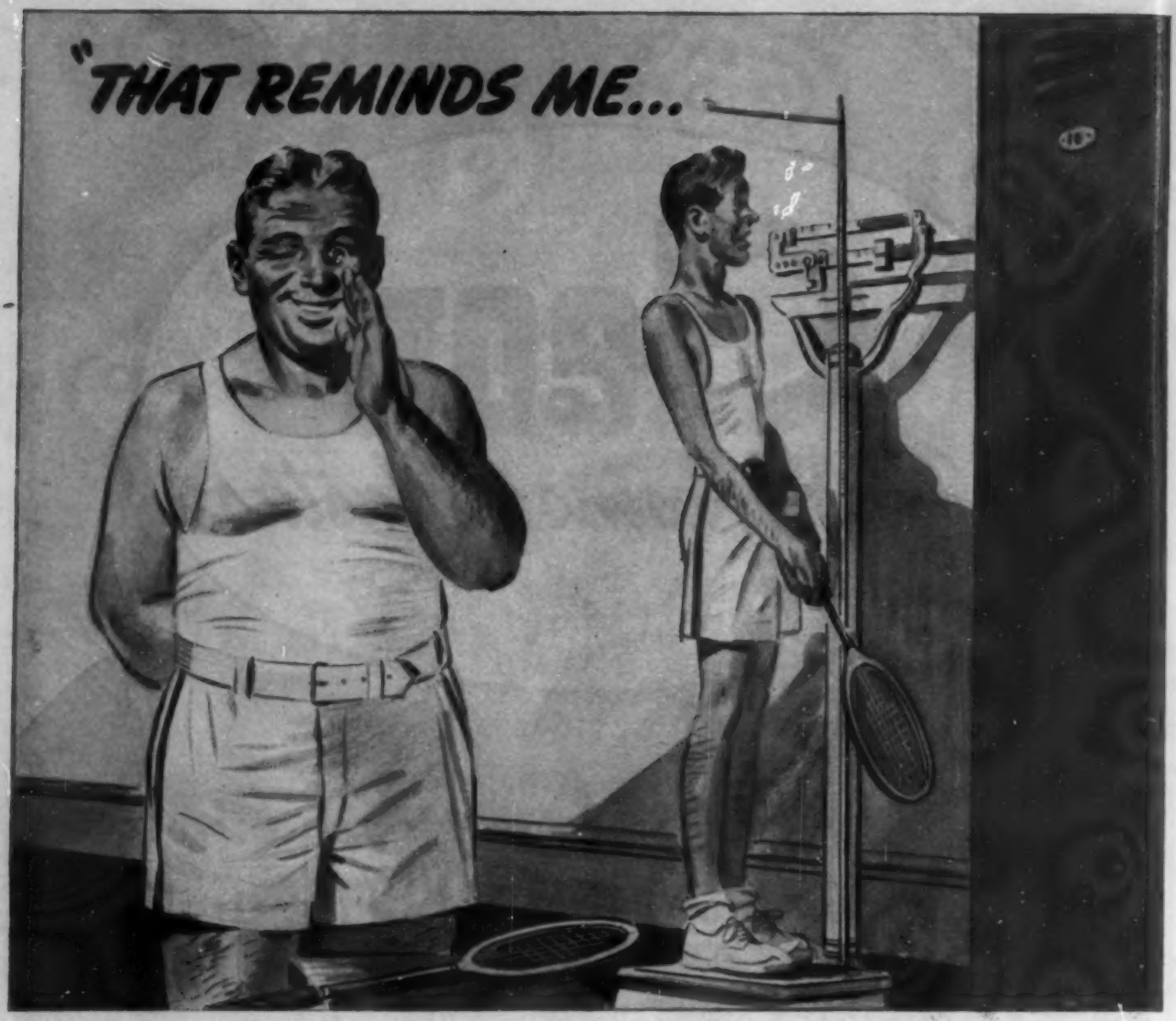
- Acids
- Alkalies
- Chemicals
- Foods
- Light
- Air
- Aging
- Flame
- Mildew
- Cold
- Heat
- Abrasion
- Sticking

Already many new — and, in some cases, revolutionary — uses have been found in such fields as plastics extrusion and molding, electronics, metals, textile, paper, packaging, rubber, food and beverage, and many others in which a seemingly limitless number of uses is yet to be discovered. For example, it has just been found that GEON, when properly blended, improves a synthetic rubber's resistance to sunlight.

Does all this suggest some new product or application or use to you? Our research staff and laboratory facilities are ready to help you. *For answers to your questions or for help on specific problems write*

Dept. I-2 CHEMICAL DIVISION
The B. F. Goodrich Company
ROSE BUILDING E. NINTH & PROSPECT CLEVELAND 15, OHIO

GEON is available to industrial users subject to allocation under General Preference Order M-10. Limited quantities can be had for experiment.



INSUROK T-601 HAS A SPECIFIC GRAVITY OF ONLY 1.35"

SCORES of military products are being adapted for civilian needs. Many of them used in aircraft owe their success to light weight. Laminated or Molded INSUROK, according to grade, has a specific gravity of from 1.06 to 2.09. It is considerably lighter than the specific gravity of aluminum which is 2.70 and is extremely strong for its weight.

If light weight combined with strength is important in the product you are developing or improving, let a Richardson Plastician suggest the grade of INSUROK best suited to your need. His experience may save you a great deal of time and money. Just write for complete information.

When product needs dictate the use of a strong, lightweight material, many designers automatically specify Laminated INSUROK. Molded INSUROK solves a host of other problems for them, too.

INSUROK *Precision Plastics*

The RICHARDSON COMPANY

MELROSE PARK, ILL. • NEW BRUNSWICK, N. J. FOUNDED 1868 INDIANAPOLIS 1, IND. LOCKLAND, CINCINNATI 15, OHIO
DETROIT OFFICE: 6-252 G. M. BUILDING, DETROIT 2, MICHIGAN NEW YORK OFFICE: 75 WEST STREET, NEW YORK 6, N. Y.

MUSTANG PILOTS FLY UNDER A CANOPY OF "LUCITE"

Flying two stock model P-51 Mustang fighters, Army flyers established a new coast-to-coast record May 12, 1944, when they flew from Los Angeles to New York in slightly more than six and one-half hours.

The Transparency of This Du Pont Plastic Provides Full Vision in All Directions at All Times!

COCKPITS of North American's P-51 Mustang fighters now carry a protective hood of transparent "Lucite." This new "teardrop" enclosure is formed from a single sheet of "Lucite" by a new process which reduces optical distortion. The design also improves rear vision for the pilot.

"Lucite" is Du Pont's trademark for its methyl methacrylate resin. Crystal-clear transparency, light weight, excellent tensile and flexural strength, resistance to chemicals, low thermal conductivity and many other properties make "Lucite" a prime favorite in different types of planes made by America's leading aircraft manufacturers.

• • •

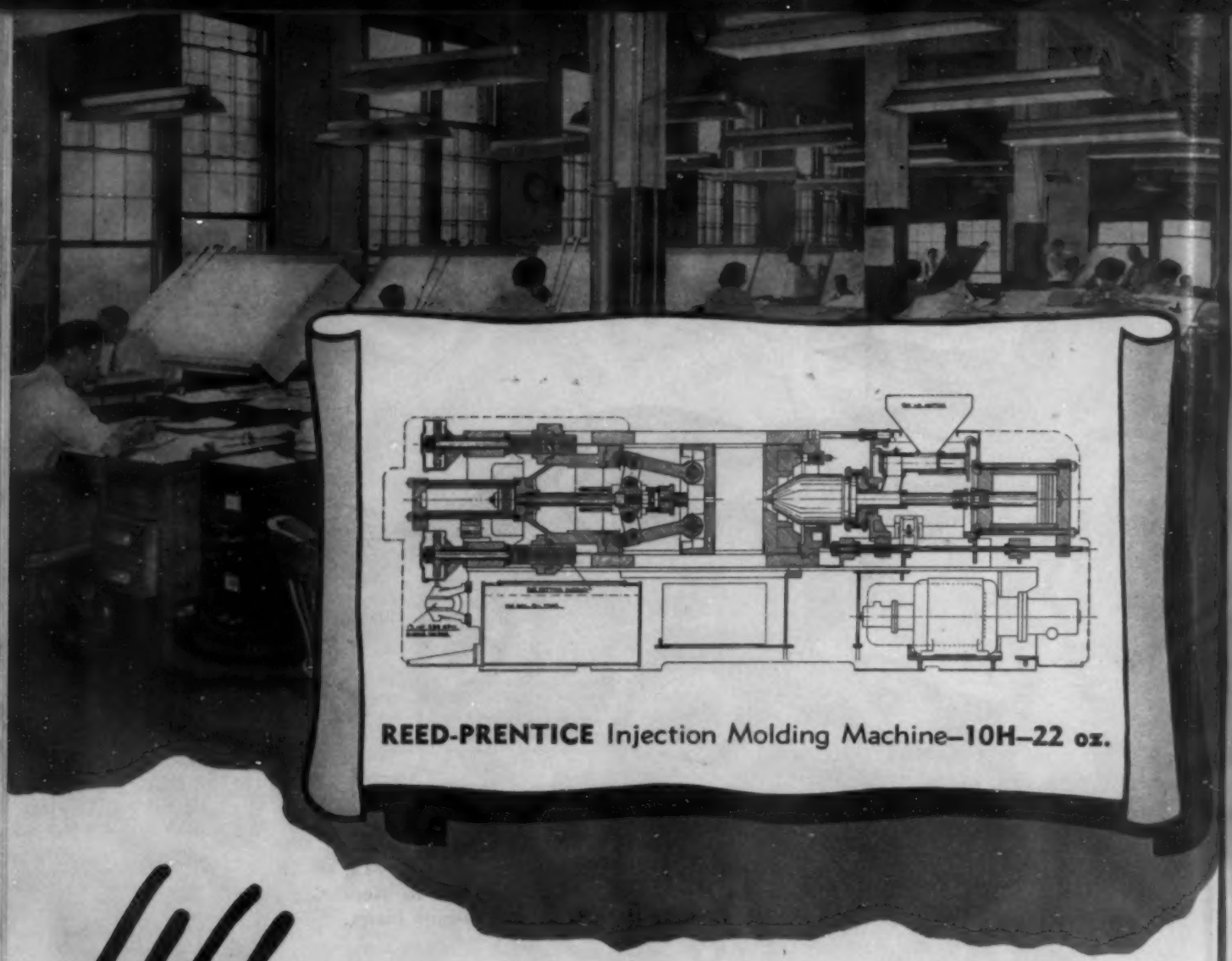
WRITE for our 114-page "Lucite" aircraft manual, which gives detailed information on its general properties, as well as on its fabrication, forming and repairing. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J., or 5801 So. Broadway, Los Angeles 3, Cal. In Canada: Canadian Industries, Ltd., Montreal.

BUY MORE THAN BEFORE—IN THE 5th WAR LOAN!

DU PONT

DU PONT PLASTICS

Better Things for Better Living . . . Through Chemistry



REED-PRENTICE Injection Molding Machine—**10H—22 oz.**

Where REED-PRENTICE

INJECTION MOLDING MACHINES ARE DESIGNED

The skills of our highly trained engineers and draftsmen are completely represented in REED-PRENTICE Injection Molding Machines. They have helped to bring the models of different capacities to their peak of world-wide use. In this department scores of developments and improvements have evolved, the result of close relations with the ever growing plastics industry and its needs — improvements embodied in new machines and simultaneously made available to earlier owners as well. Expert and continuous engineering pays dividends in machine performance.

In addition to the 10H-22 oz. illustrated above, REED-PRENTICE Injection Molding Machines are available in sizes: 10A-4 oz., 10D-6 oz., 10D-8 oz., and 10F-16 oz.

INJECTION

REED-PRENTICE CORP.

WORCESTER MACHINES MASS., U.S.A.

NEW YORK OFFICE
75 West St.
New York 6, N. Y.
CLEVELAND OFFICE
1213 W. 3rd St.
Cleveland 13, Ohio

DOMESTIC: DETROIT — Kordesbrock Machinery Co. CHICAGO — Neff Kohlbusch & Bissell. SAN FRANCISCO — Osborne Machinery Co. LOS ANGELES — Wolf Machine & Supply Co. SYRACUSE — J. F. Owens Machinery Co. HOUSTON — Preston Machine Tool Sales. MINNEAPOLIS — Charles W. Stone Co. FOREIGN: CANADA, TORONTO, MONTREAL, WINDSOR — F. F. Barber Machinery Co. SOUTH AFRICA — National Engineering, Ltd., Johannesburg. ENGLAND — Alfred Herbert, Ltd., Coventry. AUSTRALIA — Associated Machine Tools Australia, Sydney. INDIA — Alfred Herbert Ltd., Calcutta.

The pen people have a way with Plastics

The pen that decorates your desk or nestles in your pocket is a good reminder of an industry that uses plastics with a merchandising flare.

All the basic appeals of Lumarith* and Celluloid* are capitalized by these producers of writing instruments—striking colors...configurations and mottled effects...the naturally rich, glossy surface that never wears off... the pleasantness to touch that is never too cool or too warm... the light weight and toughness! These are the things which Celanese plastics can offer your product—with the greatest color range of any material.

But equally important is the Celanese approach to your problem. Celanese offers both technical and merchandising assistance. From the pioneer work with Celluloid on through the development of Lumarith sheets, rods, tubes and molding materials, Celanese has accumulated—not only production data, but marketing information as well. You will find Celanese able to keep pace with you in developing finer, more useful and more marketable products.

The Celanese technical staff is always available for consultations. Celanese Celluloid Corporation, a division of Celanese Corporation of America, 180 Madison Ave., New York 16, N. Y.

*Reg. U. S. Pat. Off.

UNLIKE THE WEATHER

Everyone talks
about plastics,
but we are ready
to do something about it!
Busy as we are
with hush-hush jobs
for our Uncle and yours,
we still may be able
to help you
because we are
the country's largest producer
of injection-molded
heavy section pieces.
Our research, development,
and die departments,
are at your service.

HAVE YOU A PLASTICS PROBLEM?

PROLON PLASTICS

EXTRA PROTECTION!

Were you to be entrusted with money—and it behooved you to get it to the bank safely, you'd be wise to call upon Extra Protection . . . Such a step safeguards the weak—makes the strong, stronger!

A die mold is an appreciable money equivalent—it represents a very important investment. Its handling deserves all the protection you can provide . . . and yet, all the protection you need give its working areas is a thin armor plate deposit of hard chromium. The die surfaces then become twice as hard as steel—remain dimensionally accurate—as smooth as a mirror—and stand off the wear and tear of constant performance.

To assure the fullest possible degree of die safety—at all times or in an emergency—call upon I.H.C.'s service "cops". They know the value of die protection and your most valuable molds are safe from destructive influences in their capable hands.

INDUSTRIAL HARD CHROMIUM CO.

"Armorplate for Industry"

15 ROME STREET • NEWARK, NEW JERSEY

Consistency in Running

This celebrated clock has been running for over 150 years. Made by Alexander Cummings of London. Circa 1790. From the famous Wetherfield Collection of English clocks on display at the galleries of Arthur S. Vernay, N. Y. C.

Consistent performance makes an antique clock valuable. And consistency is just as essential in a plastic. Molders have learned to depend on the fine running qualities of Chemaco molding powders. From drum to drum, there is a clock-like regularity in color, formula, running qualities and results.

Chemaco plastics will meet your most exacting specifications, whether they call for cellulose acetate, ethyl cellulose, vinyls or polystyrene.

Chemaco engineers are ready to offer assistance in the selection of the correct material and formula.

CHEMACO CORPORATION

A subsidiary of Manufacturers Chemical Corporation, Berkeley Heights, N. J.
Branch office in Cleveland. Representatives in Los Angeles and San Francisco.

Chemaco PLASTICS TO MOLD THE FUTURE

CELLULOSE ACETATE · ETHYL CELLULOSE · POLYSTYRENE · VINYL COMPOUNDS

Now advancing on all fronts

MILLS PLASTIC

Tubing · Pipe Fittings

It is always difficult to obtain a firm foothold for any new approach . . . whether it be invasion of a hostile foreign shore or overcoming unreasoning resistance to a revolutionary product. Contrary to the usual battle for acceptance, MILLS PLASTIC* tubing, pipe and fittings found a ready welcome because of their practical adaptability in a wide variety of applications. And, their use is increasing daily due to the ideal combination of characteristics which enable these products to conquer seemingly impossible problems.

MILLS PLASTIC successfully demonstrates its exceptional qualities under high bursting and working pressures . . . besides having the important advantages offered by its fine insulating properties, resistance to most chemicals, flexibility and ease of handling. In many cases, these combined endowments of MILLS PLASTIC make it superior to the vital metals it has replaced.

MILLS PLASTIC tubing is available in outside diameters of ⅛" through ¾", in a variety of wall thicknesses. Special sizes of tubing on request.

MILLS PLASTIC pipe can be obtained in outside diameters of ½" through 4".

*Write on your letterhead for the Injection Molded and Extruded Plastics Catalog III or for the MILLS PLASTIC tubing and fittings circular. *Made of Saran.*

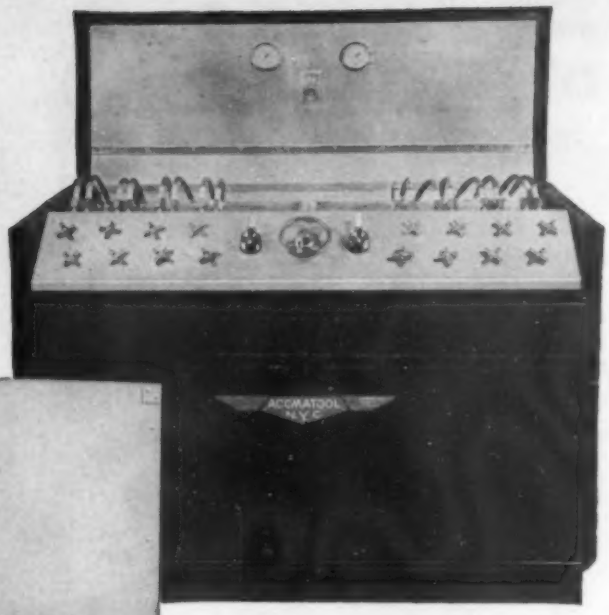
ELMER E. MILLS CORPORATION

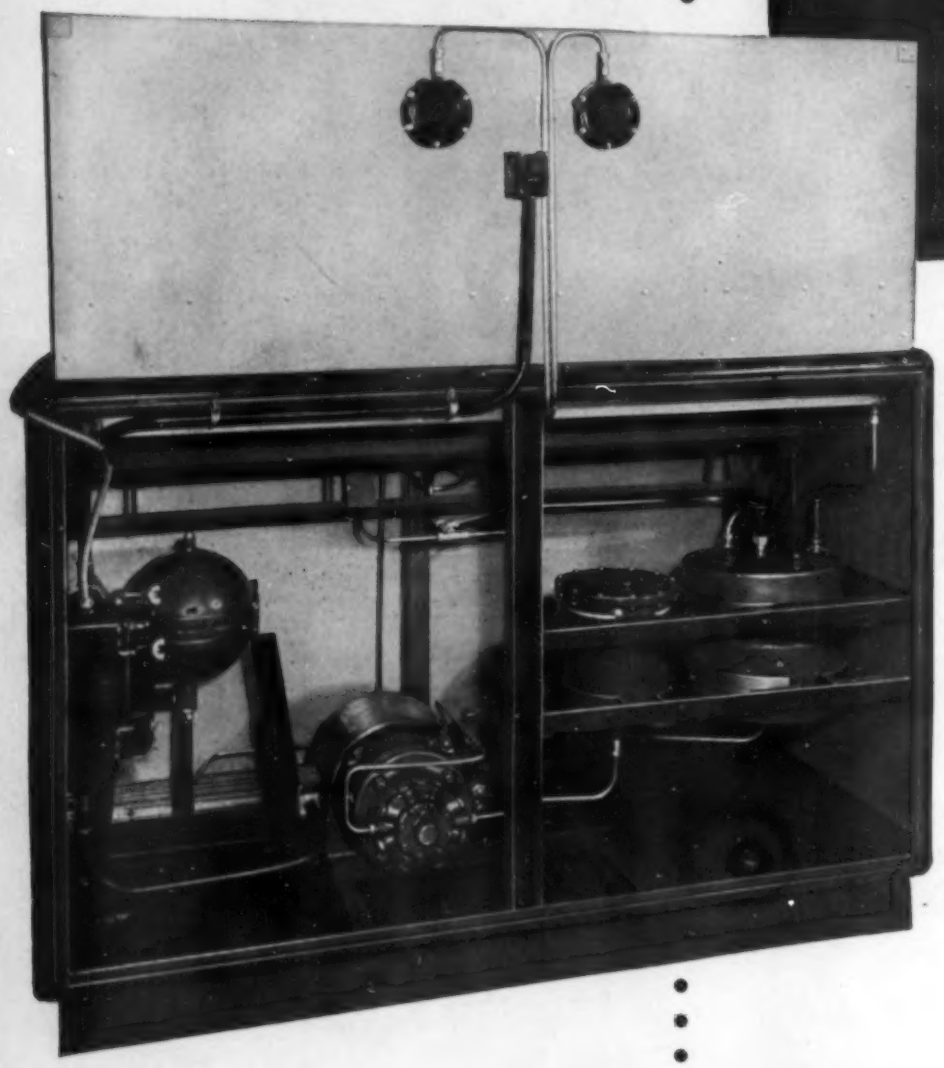
Molders of Tenite, Lumarith, Plastacele, Fibestos, Lucite, Crystallite Polystyrene, Styron, Lustron, Loalin, Vinylite, Mills-Plastic, Saran and other Thermoplastic Materials

153 WEST HURON STREET, CHICAGO 10, ILLINOIS

HYCON

REGISTERED TRADE MARK





Hydraulic Units Assemble into 3000 p. s. i. Test Equipment and Benches

3000 p.s.i. Cylinder Test Bench
Manufactured by
Accmatool Corp. of New York, N. Y.

PUMPS
ACCUMULATORS
PRESSURE METERING VALVES

4-WAY VALVES
UNLOADING
AND RELIEF VALVES

Specifications and Engineering Data on Request

THE NEW YORK AIR BRAKE COMPANY

Hydraulic Division

420 Lexington Avenue, New York 17, N. Y.

WHEN YOU'RE IN A *Tight Spot* . . . TRY NIXON

Send out an SOS for an outfit . . . like NIXON. We strive to meet your deadline . . . despite all obstacles.

NIXON Plastics

MATERIALS: Cellulose Acetate • Cellulose Nitrate • Ethyl Cellulose
AVAILABILITY: Sheets • Rods • Tubes • Extruded Profiles
Cellulose Acetate and Ethyl Cellulose Molding Powder

NIXON NITRATION WORKS • NIXON, NEW JERSEY

M. FAHRINGER
1635 West Farwell Ave.
Chicago, Ill.

C. D. KERR, JR.
5600 Bedford Road
Detroit, Mich.

A. F. PERRY
Leominster
Mass.

W. S. MOWRY
126 Marsdon St.
Springfield, Mass.

C. B. JUDD
401 Loudermann Bldg.
St. Louis, Mo.

NORTHWEST PLASTICS INDUSTRIES
921 Terminal Sales Bldg.
Portland, Ore.

415 Fourth Cherry Bldg.
Seattle, Washington

HOBBS GLASS, LTD., *Canadian Distributors*—Quebec • Montreal • Ottawa • Toronto • Hamilton
Brantford • London • Windsor • Winnipeg • Moose Jaw • Saskatoon • Vancouver • Victoria

Odds Are in Your Favor

Chances are you'll gain by sitting down with one of our very practical field men to discuss your coated abrasive operations.

You'll find his familiarity with the newest sanding machines as well as his complete knowledge of the thousands of forms we make very helpful in these busy times when greater output through faster, better finishing is so important and yet seemingly unattainable.

He may even recommend, to your advantage, converting some existing method to the high speed mechanical use of modern abrasive paper or cloth.

Just that one idea—conversion; why not explore its possibilities? You certainly can't lose.

BEHR-MANNING
(DIVISION OF NORTON COMPANY)
TROY, N. Y.

QUALITY ABRASIVES
NORTON ABRASIVES

BRANCHES: Boston, Buffalo, Chicago, Cleveland, Cincinnati, Grand Rapids, High Point, Indianapolis, Detroit, Los Angeles, New York, San Francisco, Philadelphia, St. Louis, Tacoma.

It may seem strange to think of glass adding great impact strength to any material. Yet that is just what happens when Fiberglas*—in the form of woven glass fibers—is used to reinforce certain plastics.

This combination has resulted in a new kind of structural material with some qualities which excel those of any other material now known!

Besides its surprising ability to absorb shock, this new Fiberglas-plastic material combines great strength (in tension and compression) with very low weight. It also has dimensional stability (neither shrinks nor stretches) and has high fatigue resistance under vibration and other stresses.

All these features have combined to provide outstanding advantages for many special applications on military aircraft.

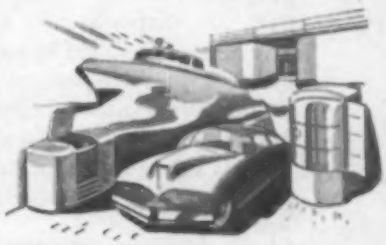
Another real value of this glass-reinforced plastic is the ease with

which it is fabricated into complex shapes and forms. Expensive dies and great pressure aren't needed. Machining is quick, accurate and clean.

Admittedly, there is much to learn about this new material. Some authorities have called it a new material of construction. The ingenuity of engineers and designers of the plastics industry will broaden its use.

Manufacturers and design engineers desiring more information regarding this revolutionary development or the reinforcing Fiberglas Textile materials, now available in quantity, are invited to write: *Owens-Corning Fiberglas Corporation, 1876 Nicholas Building, Toledo 1, Ohio; in Canada, Fiberglas Canada, Ltd., Oshawa, Ont.*

AN *Opportunity*
FOR ENGINEERS
AND DESIGNERS



Plastics reinforced with Fiberglas Textiles should be of great interest to designers, engineers and manufacturers seeking a stronger, lighter weight, more durable material. We'll gladly help you get acquainted with fabricators now making this amazing new material.

FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

ARMY E NAVY

STURDY

Kux Preform Presses

THE NEW MASSIVE MODEL 65 PRODUCES PREFORMS 3″ DIAMETER, HAS A 3″ DIE FILL AND APPLIES 75 TONS PRESSURE

This rugged preform press with its heavy duty, one-piece cast steel main frame will produce odd shapes as well as round preforms. The pressure applied by both top and bottom punches results in more solid, dense preforms, which have less tendency to crumble or break during handling. This new Model 65 press is built to safely withstand high pressures of up to 75 tons at top production efficiency.

Choice of a complete size range of machines in both single punch models and multiple punch rotaries is also available.

● Write Dept. P for catalog or demonstration

Model 65

KUX MACHINE COMPANY

3924-44 WEST HARRISON STREET · CHICAGO 24

When Victory comes, every manufacturer will be interested in *Velon* . . . Firestone's new material of almost limitless uses.

For it can be woven into fine fabrics, or spun to steel-cable toughness . . . in infinite patterns and in *any* color.

You'll first be seeing *Velon* as the virtually imperishable upholstery material of car, bus, train, and plane seats . . . in brighter, gayer effects than ever possible before.

You'll find many uses for *Velon* . . . because it's stainless and non-inflammable . . . can be wiped clean and colorful as new in a few seconds.

Keep your eye on *Velon*. It will play an important part in everyone's life . . . postwar!

*Trade Mark pronounced VEL-ŎN

ANOTHER CONTRIBUTION TO A BETTER WAY OF LIFE by

Firestone

For the best in music listen to the Voice of Firestone Monday evenings over the entire NBC Coast to Coast network.

Get flexible lighting

for each employee . . . each job . . .

with DAZOR *Floating* LAMPS

MORE PRODUCTION

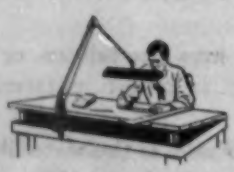
Both machine and hand operations go faster, more smoothly, with controlled localized lighting. Dazor *Floating* Lamps help employees improve and maintain efficiency.

HIGHER ACCURACY

Adequate lighting aids precision, reduces errors, conserves materials by cutting down spoilage. Dazor high intensity illumination is just right for inspection tasks.

GREATER SAFETY

By lighting dark areas and danger points, eliminating reflected glare, reducing eyestrain and fatigue, Dazor *Floating* Lamps help to check accidents at the source.



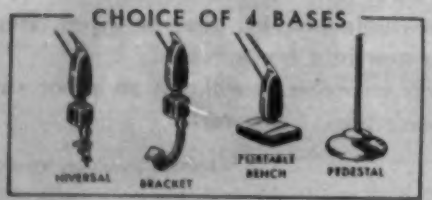
LOWER COSTS

Dazor *Floating* Lamps deliver productive, economical light. Option of fluorescent or incandescent lamps and 4 base types provides a correct fit for each installation.

Employees differ . . . and jobs differ . . . in their lighting needs. That, in a nutshell, is the reason for the Dazor *Floating* Lamp—the first lamp with complete lighting *flexibility* at the point of work. The operator's finger-tip touch *floats* the Dazor Lamp to the exact position desired, where it *stays put* without fastening. An enclosed balancing mechanism holds the lamp arm at the place chosen . . . firmly . . . automatically.

At the left are typical advantages of Dazor illumination on machine tools, assembly lines, inspection benches and drafting boards. To gauge these economies fully, get details from your experienced and cooperative Dazor-appointed distributor. If you'd like this 16-page descriptive booklet, ask for Booklet "P"; we'll send it promptly. Dazor Manufacturing Co., 4467 Duncan Ave., St. Louis 10, Mo.

CHOICE OF 4 BASES



Call your electrical wholesale supplier or write us for the names of our distributors in your locality.

DAZOR *Floating* LAMPS

FLUORESCENT *and* INCANDESCENT

ALL THREE AND COUNSEL, TOO!

Today, plastic products and parts are important functionally. Therefor, their manufacture calls for the use of materials whose properties deliver the required performance under specified conditions. Since we work with many formulations—and with all three processes for molding—Consolidated maintains a complete materials control laboratory and an engineering service division . . . to counsel with customers . . . to determine the one correct material . . . and to insure its proper production procedure.

In that the assemblies shown here exemplify practical design—perfect material choice—ingenious mold making and flawless production, we present them as an invitation for you to test Consolidated's brand of plastic satisfaction.

Consolidated
MOLDED PRODUCTS Corporation
309 CHERRY STREET, SCRANTON 2, PA.

New York—1790 Broadway Bridgeport—Rocky Ridge Drive Cleveland 5713 Euclid Ave. Detroit—2970 W. Grand Blvd. Chicago—549 W. Randolph St.

PLASTIC LAMINATES

A few current applications of

RIEGEL-X PAPERS

THE ACCEPTED STANDARD
FOR PAPER BASE
LAMINATED PAPERS

Start thinking now how Riegel-X Papers may fit into your present and post-war actiities.

PHOTOS COURTESY OF VIDAL RESEARCH CORPORATION.

WRITE FOR INFORMATION AND SAMPLES

103

RIEGEL PAPER CORPORATION • 342 MADISON AVENUE • NEW YORK 17, N. Y.

RIEGEL-X

X A group of plain and impregnated base papers for both fluid and direct pressure plastic laminates X

STIC BOAT...in Cellulose
ate! *Chemold*, Ethyl
ose plastic by Western
s, Inc., is ideally suited
king such boats light,
weather-worthy.

CELLULOSE PLASTICS ARE *LIGHTWEIGHT*!

Wherever the weight-factor is of prime importance—when your product has to be both exceptionally light *and* superlatively tough—be certain to look carefully into the properties of the plastics based on Cellulose. Few materials have such low specific gravity. Few have such inherent toughness. Few lend themselves to such a variety of molding methods—by injection, compression or extrusion, or as laminates with paper, cloth and other materials.

Hercules does not make plastics, but as a leading producer of Cellulose derivatives is working constantly to supply those who do make plastics with even better and more versatile base materials. For literature and other data based on our years of Cellulose research, address Cellulose Products, Department MP-74,

Hercules Powder Company, Wilmington 99, Delaware.

HERCULES

CELLULOSE ACETATE
CELLULOSE NITRATE
ETHYL CELLULOSE

TOUGH · FLEXIBLE · STABLE · LIGHTWEIGHT · CLEAR · ECONOMICAL

HOUSINGS FOR THE ingenious Rist-lite flashlight had to be both feather-light and tough. And both these characteristics were found in Cellulose Acetate plastic, molded by Sterling Plastics, Inc.

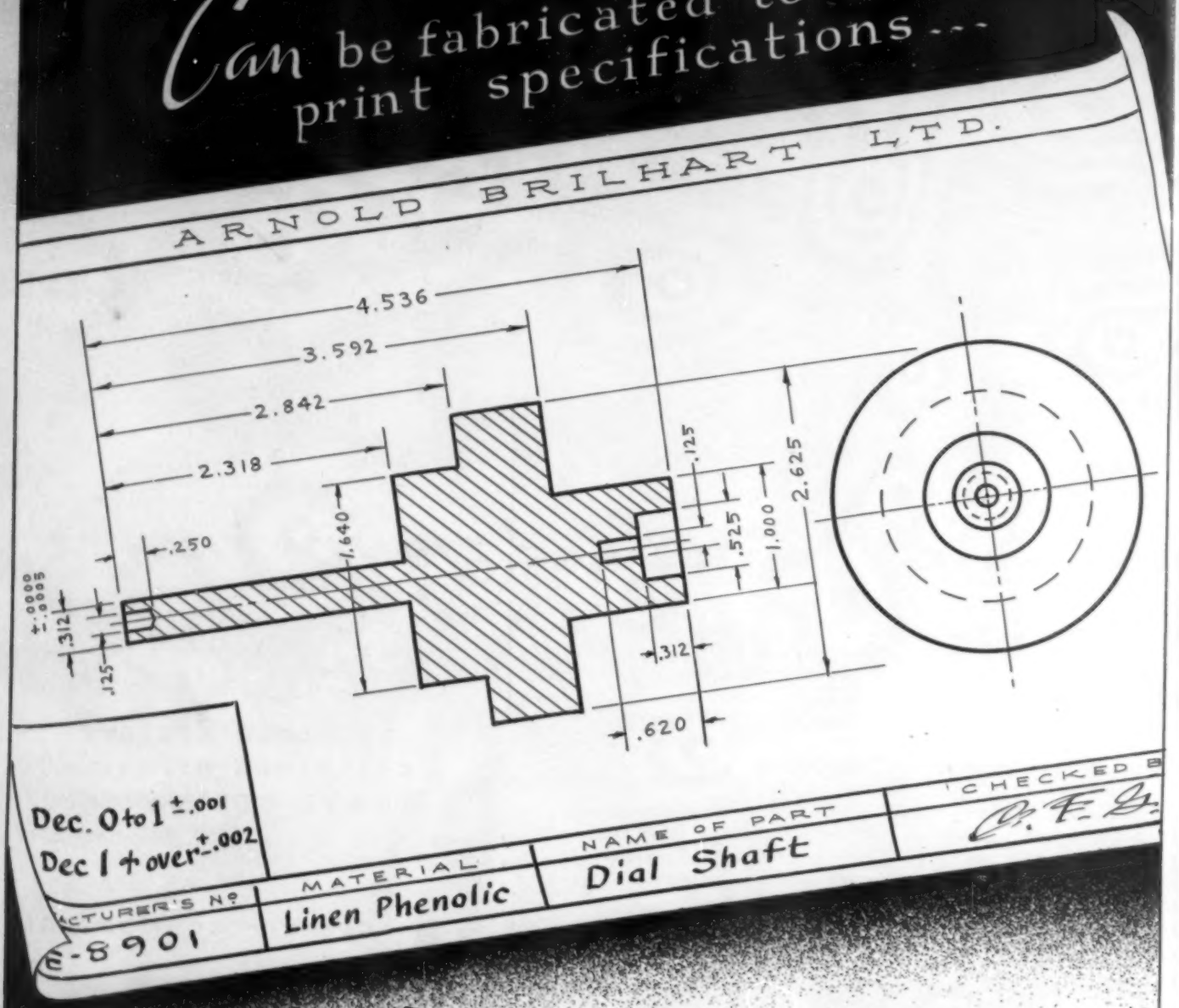
TO SAVE EVERY OUNCE of weight is imperative in military aircraft. Therefore, the radio compass antennae of certain planes are housed in lightweight Acetate, molded by the Czecho-Peasant Art Company.

THE VENTURI TUBE by means of which speed and altitude are measured for the pilot and navigator, is another important use of lightweight plastic on military planes. Molded of *Lumarith* Ethyl Cellulose.

DDD-102 © 1944 HERCULES POWDER COMPANY

Plastics

Can be fabricated to these print specifications ---



Send your **Tough** plastic problems to

ARNOLD **Brilhart** LTD.

435 MIDDLE NECK ROAD • GREAT NECK, N.Y. • *phone*: GREAT NECK 4054

FAILURE
THAT DEMONSTRATES
BONDING
SUCCESS

ALUMINUM
Cordo-Bonded
to
PLYWOOD

100% wood failure

Actual Photograph

Other typical Cordo-Bonds when tested in shear

METAL	WOOD	SHEAR STRENGTH	WOOD FAILURE
Steel	Birch Plywood	700 lbs. psi	100%
Aluminum	Birch Plywood	700 lbs. psi	100%
Iron	Mahogany	1300 lbs. psi	80%
Steel	Oak	1800 lbs. psi	60%
Stainless Steel	Oak	1300 lbs. psi	80%
Steel	Maple	1000 lbs. psi	75%
Aluminum	Maple	1100 lbs. psi	80%

CORDO-BOND Adhesives may be able to solve some of your present or post-war problems in bonding *metal, plastics, wood, glass, paper, cloth* or *leather.* Please write, giving details for specific analysis or request Catalogue outlining CORDO-BOND Adhesives, uses, characteristics, bonding processes.

CORDO CHEMICAL CORPORATION
34 Smith St., Norwalk, Conn.

INDUSTRIAL COATINGS • FINISHES
INDUSTRIAL ADHESIVES

CORDO-BOND

TEXTILE FABRICS

FOR PLASTIC LAMINATES

The 20 mills in the Deering Milliken group, with nearly a million spindles and 25,000 looms, produce a wide variety of cotton and synthetic fabrics. Our facilities and knowledge of textiles are at the service of the plastics industry.

DEERING MILLIKEN & COMPANY

INCORPORATED

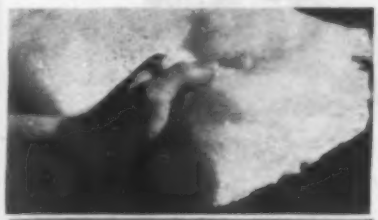
240 CHURCH STREET, NEW YORK 13, N. Y.

Chicago Sales Office:
300 West Adams Street

Los Angeles Sales Office:
111 West Seventh Street

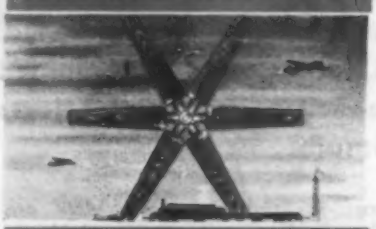
Dallas Sales Office:
503 Texas Bank Bldg.

When to use a *Specification* Resin



FOR FIBERGLAS C.P.C. developed a film-binding adhesive that permits precision control of the final resiliency or rigidity of the products.

FOR PLYWOOD [illegible] lumber company, C.P.C. developed a resin that gave ease, greater strength, and a more lasting bond.



FOR COMPREGWOOD C.P.C. created an impregnating resin for manufacturer whose propellers were first to meet Army-Navy specifications.

USE of "stock" resins—only *approximately suited* to specific applications—is a common and avoidable source of many resin "problems."

Because—*unless* ALL *the functional and production requirements of two applications are* IDENTICAL *with one another* (a rare occurrence), exactly the same resin can not be used with *maximum* success for both.

However, the chemicals from which phenolic resins are obtained *can* be varied in an almost *infinite* number of combinations—to produce resin properties *precisely fitted* to any one of a wide range of applications.

Hence—when a resin is scientifically prepared for *one specific application*—job-tested—and its production stabilized (held within extremely close range of variation) the best results are obtained (see examples on this page).

That's why C.P.C. recommends, and has specialized in, the development and stabilization of *specification* resins. That's why important industrial users come to C.P.C. for practical solutions to major resin problems.

If you have a resin problem or contemplate using resins in any operation or process, write Central Process Corporation, 1401 Circle Ave., Forest Park, Illinois.

CPC

CENTRAL PROCESS CORPORATION

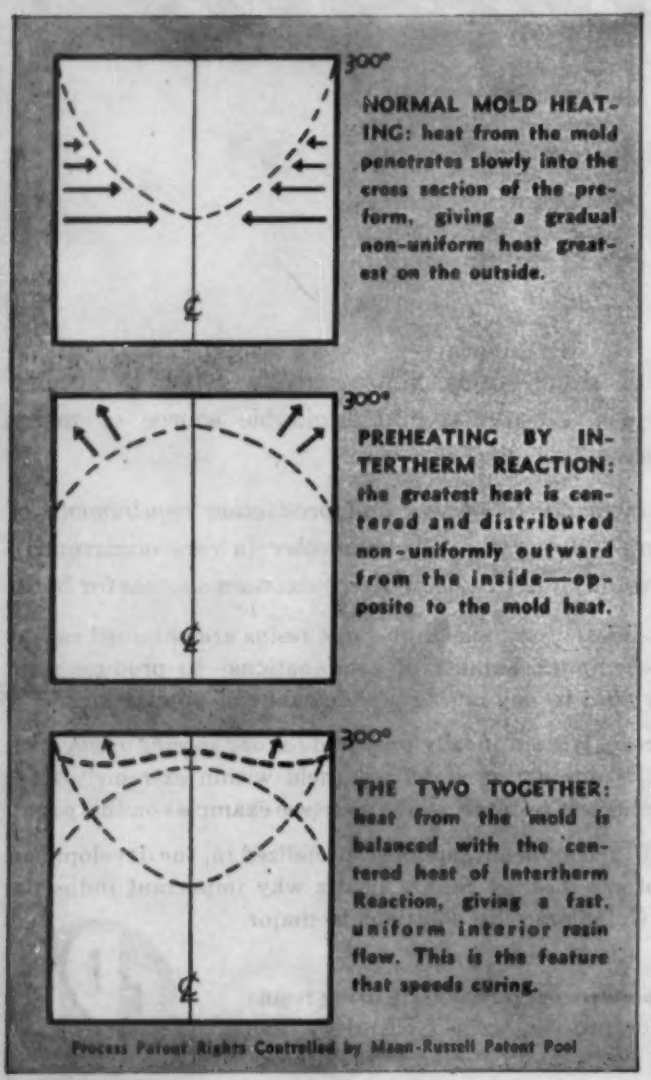
When a LITTLE resin made a BIG difference!

carburetor diaphragm

A LEADING MANUFACTURER of aviation equipment (name on request) presented this problem: This manufacturer's carburetors are vital equipment for motors of American fighters, bombers and transports. In these carburetors, a rubber diaphragm is sandwiched between two parts of a metal housing. Lack of rigidity made it slow and difficult to insert bolts without damaging diaphragm. If diaphragm could be bonded to a metal ring, assembly time would be cut, and safe removal, cleaning and replacing of diaphragms facilitated. A metal-to-rubber bonding agent, resistant to immersion in gasoline, benzine, alcohol—and not acid activated—was required. For Chicago Belting Company (supplier working on the problem) C.P.C. created a resin—a *thin film of which does that job*—meeting all requirements. That C.P.C. Resin is now SPECIFIED for the job. Another notable example of the value of *specificity*, the quality of being precisely adjusted to a specific application.

These Charts Show Why NON-UNIFORM Electronic Preheating with

These charts tell the story of and show what happens during the first instants of molding pressure.


300°
NORMAL MOLD HEATING: heat from the mold penetrates slowly into the cross section of the preform, giving a gradual non-uniform heat greatest on the outside.
300°
PREHEATING BY INTERTHERM REACTION: the greatest heat is centered and distributed non-uniformly outward from the inside—opposite to the mold heat.
300°
THE TWO TOGETHER: heat from the mold is balanced with the centered heat of Intertherm Reaction, giving a fast, uniform interior resin flow. This is the feature that speeds curing.
Process Patent Rights Controlled by Mann-Russell Patent Pool

Write Northwest Syndicate now for detailed technical data and price list. This company's continuing research program is devoted to helping you solve your production problems through the proper application of RF heat generation.

Intertherm* Reaction

Produces Moldings Faster and Better!

"Intertherm Reaction" is the M&R term meaning that the greatest concentration of dialectric heat is centered in a preform during preheating. Because of this, internal preheating and external mold temperatures are balanced (as shown at the left) — giving fast, uniform flow characteristics even when intricate molds are used. Production is speeded, larger pieces are molded on the same press capacity, flash and rejects are reduced to a minimum.

★ **M&R preheating generators are available with automatic self-compensating preform ovens of an exclusive type. No adjustments in electrode plates are necessary for preforms of varying sizes. Performance is consistent, so the same results are achieved time after time. Units can also be adapted to continuously preheat preforms on a conveyor system.**

★ **Sturdy all-metal M&R preheating units are available for fast delivery—complete and ready for installation in your plant. In sizes and BTU ratings for every molding job, M&R preheating units feature automatic timers, self-adjusting electrodes, simplicity of control and compact, portable design. Units are available for outright sale or lease.**

MANN-RUSSELL *high frequency* PREHEATING GENERATORS

m and R RF SYSTEM

NORTHWEST SYNDICATE, INC.
711 St. Helens Ave., Tacoma 1, Washington
Operated by Geo. F. Russell and Julius W. Mann

Chairs that float in space?

If we follow the current trend in designing post-war furniture, the ultimate elimination of legs is the only logical outcome. We will probably be sitting in chairs that float in mid-air.

This is for the people that go for post-war dreams.

The rest of us need something a little bit more substantial to carry our weight and our particular offering is extruded plastics.

We have pioneered the application of extruded plastics in the furniture industry—we did this long before the war. They make furniture lighter, brighter and more durable. We have a lot of ideas for the post-war application of extruded plastics to the furniture industry, some of which are in the blueprint stage. We are working with designers now toward the post-war goal.

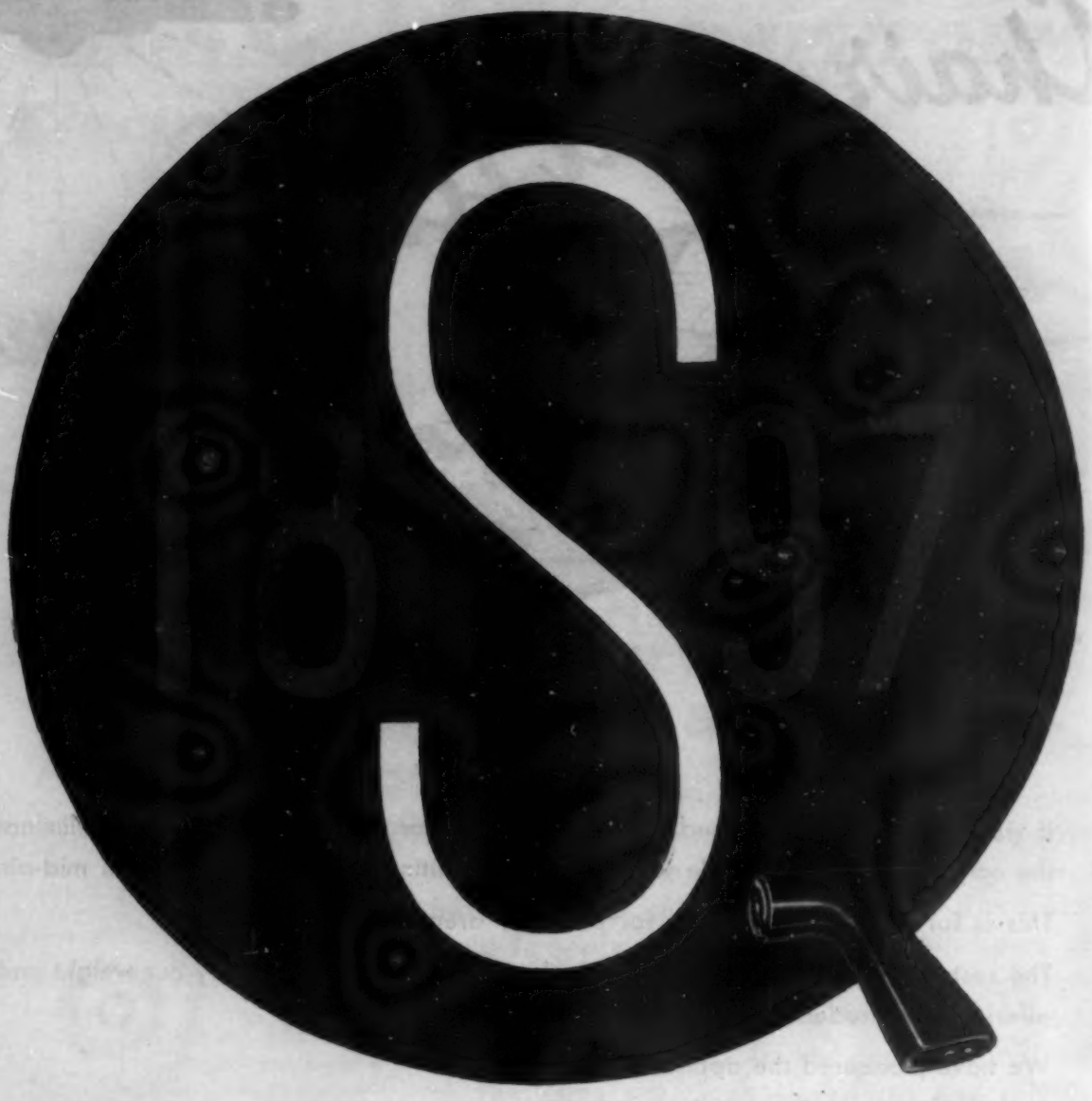
We also do injection molding.

SOCIETY OF THE PLASTICS INDUSTRY · SPI

DETROIT MACOID CORPORATION

12340 Cloverdale Ave.
Detroit, Michigan

ORIGINATORS OF DRY PROCESS PLASTIC EXTRUSION



WHO SAID PLASTICS IS A NEW INDUSTRY?

Not at Stokes it isn't. We've been making hard rubber and plastic parts—thousands of them—since 1897. Forty-seven years of experience to share with you in planning your present or post-war products! We've got ideas, a research staff and an up-to-date manufacturing plant to help you every step of the way in solving your problems.

JOS. **STOKES RUBBER** CO.

Molders of Plastics and Hard Rubber

Established 1897

TRENTON, N. J.

In Canada: Jos. **STOKES RUBBER** Co., Ltd., WELLAND, ONT.

Navigators sight accurately through Plexiglas astrodomes

Over the target with precision . . . home to a distant base . . . navigators guide America's bombers on their far-ranging flights

* * *

THEY sight their octants through curved PLEXIGLAS sections called astrodomes. These are precision optical parts, every one meeting critical sighting specifications—yet Rohm & Haas has made them by the tens of thousands, using a special vacuum forming process developed in our plant before the war.

As pioneers in the manufacture and fabrication of acrylic plastics, Rohm & Haas has assisted in the successful use of PLEXIGLAS in hundreds of other aircraft and automotive applications.

TECHNICAL COOPERATION

You are invited to take advantage of the cooperation of the Rohm & Haas technical staff in the determination of best optical contours . . . discussion of mechanical details . . . fabrication of experimental sections . . . and assistance in all other phases.

Offices in: Philadelphia, Detroit, Los Angeles, Chicago, Cleveland, New York. Canadian Distributor, Hobbs Glass Ltd., Montreal, Quebec.

***Only Rohm & Haas makes* PLEXIGLAS**

PLEXIGLAS is the trade-mark, Reg. U.S. Pat. Office, for the acrylic resin thermoplastic sheets, rods and molding powders manufactured by Rohm & Haas Company

Represented by Cia. Rohm y Haas, S.R.L., Carlos Pellegrini 331, Buenos Aires, Argentina, and agents in principal South American cities.

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries

plywoods bonded with P-398 PLYOPHEN zoom past all army-navy tests

Here's a resin glue for plywood bonding with everything a bonding agent ought to have.

P-398 Plyophen is easy to use: No catalyst is required . . . it can be used as received or thinned with water . . . it will give satisfactory results with or without walnut shell flour.

P-398 Plyophen simplifies manufacturing: Pressures from 50 lbs. to 250 lbs. are sufficient . . . it cures in 4 to 6 minutes at temperatures from 250 to 300°F.

P-398 Plyophen produces sound plywood: Wood failures are very high—averaging 90 to 100% . . . break tests, wet and dry, are well over Army-Navy Aeronautical Specifications AN-NN-P-511b—as well as Commercial Standards CS45-42 for exterior types of Douglas Fir plywood.

Just as important—***P-398 Plyophen is available in volume***—as are all the RCI phenolic bonding and impregnating resins in the extensive Plyophen line.

Write for exact details of numerous tests and recommended application methods direct to the Sales Department in Detroit.

RCI

WORLD-WIDE DISTRIBUTION

REICHHOLD CHEMICALS, INC.

ARMY E NAVY

General Offices and Main Plant, Detroit 20, Michigan

Other plants: Brooklyn, New York • Elizabeth, New Jersey • South San Francisco, California • Tuscaloosa, Alabama • Liverpool, England • Sydney, Australia

SYNTHETIC RESINS • CHEMICAL COLORS • INDUSTRIAL PLASTICS • INDUSTRIAL CHEMICALS

The Invasion Is On!

Play Your Part By Buying More War Bonds Than Ever Before

GAYLORD CONTAINER CORPORATION, General Offices: SAINT LOUIS

CORRUGATED AND SOLID FIBRE BOXES
FOLDING CARTONS ... KRAFT GROCERY BAGS AND SACKS ... KRAFT PAPER AND SPECIALTIES

New York • Chicago • San Francisco • Atlanta • New Orleans • Jersey City • Seattle • Indianapolis
Houston • Los Angeles • Oakland • Minneapolis • Dallas • Jacksonville • Columbus • Tampa
Fort Worth • Detroit • Cincinnati • Des Moines • Oklahoma City • Portland • Greenville • St. Louis
San Antonio • Memphis • Kansas City • Milwaukee • Bogalusa • Weslaco • Hamden • Appleton

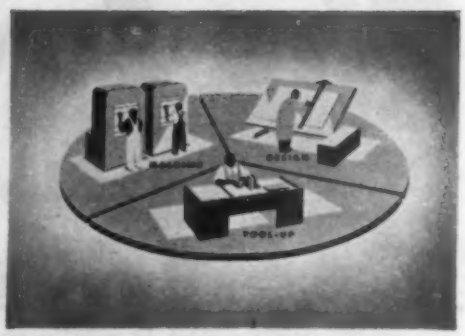
Material makes a difference . . . see your Plastics Molder early!

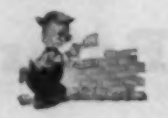
They take knowing, these plastic compounds—as only the custom molder who has worked with them for years can know them. And this knowledge has to be on the job early. Here's why:

1. *There are hundreds* of basic compounds, most with special-purpose sub-categories—and all with special characteristics. Only full experience can select the best one for the end-use planned.

2. *Material choice affects design.* Good molds are engineered in accord with material specifications as to wall-sections, tolerances, strength factors, handling of inserts, etc.

3. *Molding and finishing* processes and schedules both depend on this combination of material and design. Because of the way every molding function must dovetail into the other, the Kurz-Kasch Round Table has proved especially effective in producing hard-to-make molded parts. Experts representing over a generation of experience in every phase of Plastics production pool their knowledge in advance—to insure on-schedule production of precision parts under accurate cost control. Backed by the facilities of one of the largest, best equipped exclusive custom molding plants in the country, Kurz-Kasch is *planning today* for a great deal of *production tomorrow.* Ask for a Kurz-Kasch representative.





LET KURZ-KASCH select material and work out design *now* . . . produce molds *now,* if possible . . . and you'll be in a great position to avoid *future* production headaches. There'll be a terrific rush!

HOW ABOUT AN EXTRA WAR BOND—NOW?

KURZ-KASCH

For over 25 years Planners and Molders in Plastics

Kurz-Kasch, Inc., 1421 South Broadway, Dayton 1, Ohio
Branch Sales Offices: New York • Chicago • Detroit • Indianapolis • Los Angeles • Dallas
St. Louis • Toronto, Canada. Export Offices: 89 Broad Street, New York City

THIS PRESS SERVES *Many* PURPOSES

For general utility work in the plastic industry Watson-Stillman has designed this ALL-PURPOSE Hydraulic Press. It is made in sizes and capacities to suit varying conditions—from the 20-ton machine with 8 x 8 in. platens, to the 200-ton machine (shown here) with 20 x 20 in. platens.

This press is sturdy, compact, self-contained and oil operated. The power equipment is enclosed in the welded steel cabinet which also forms the base of the machine. Control is by means of a hand lever, located conveniently on the front of the machine. This press is ideally suited for laboratory work to perform experiments under conditions approaching actual high-production service. The Watson-Stillman Co., Roselle, New Jersey.

WATSON-STILLMAN

BULLETIN No. 370-A

Watson-Stillman has just prepared Bulletin No. 370-A covering the complete line of these General Purpose Presses. Detailed descriptions of the machines, their construction, equipment, and specifications of the several sizes and capacities are included. Write on your business letterhead for your copy.

DESIGNERS AND MANUFACTURERS OF HYDRAULIC EQUIPMENT, FORGED STEEL FITTINGS, AND VALVES

AIRTRONICS Preheaters

Speed Closing and Curing by 310%

ALLISON ELECTRODE HOLDER Tip Data

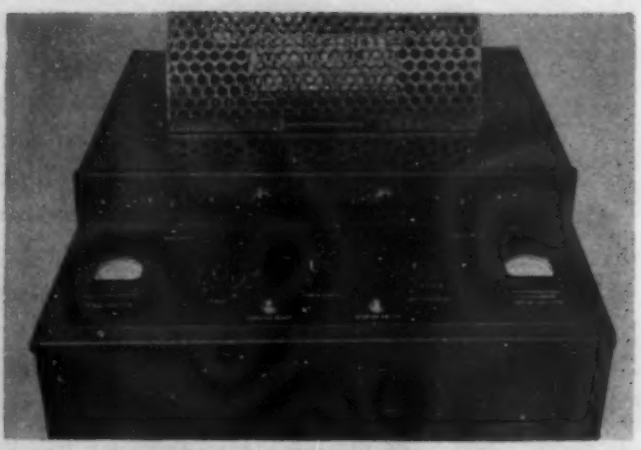
Former Method	Operation	Preheating by Airtronics
20 min.	HEATING PREFORMS	1½ min.
150° F.	CORE TEMP. OF PREFORMS	325° F.
1½ min.	CLOSING TIME	20 sec.
15 min.	CURING TIME	5 min.

In molding these asbestos-filled phenolic-compound welding rod holder tips, the maximum of impact strength and heat resistance had to be achieved—and yet on a commercially practical cost-basis. Attempts to preheat the preforms by convection methods were tried, but sufficient production could not be reached. AIRTRONICS engineers were then called in, and tests quickly proved that two-thirds the time required for closing the dies and curing could be eliminated through the use of *Airtronics* preheaters.

A saving of 11 minutes 10 seconds on closing and curing time was achieved by AIRTRONICS' preheating. Higher impact strength and heat resistance of the finished product resulted from better plasticizing. A stronger bond was obtained between the six-ounce hollow steel insert and the phenolic. And, six holder tips can now be molded at one time from the one-pound preforms.

Quoting Windman Brothers, West Coast molders specializing in difficult molding jobs: "The AIRTRONICS preheater will pay for itself within six months, and in addition we are delivering a product of vastly higher quality." Such user-acceptance as this is typical among those operating AIRTRONICS heat generators, and the more difficult the molding job, the more important to them are the advantages of AIRTRONICS preheaters.

SEND FOR YOUR COPY of new bulletin. Find out about AIRTRONICS dependability . . . about their self-contained electrodes, safety devices, and simplified controls . . . find out how your plant can increase production, reduce unit costs and improve quality of moldings with this advanced equipment. Send for your copy today.



Note the simplicity of AIRTRONICS' controls and the convenient location of guarded electrodes.

AIRTRONICS MANUFACTURING COMPANY

CHICAGO
121 W. Wacker Drive
Zone 1

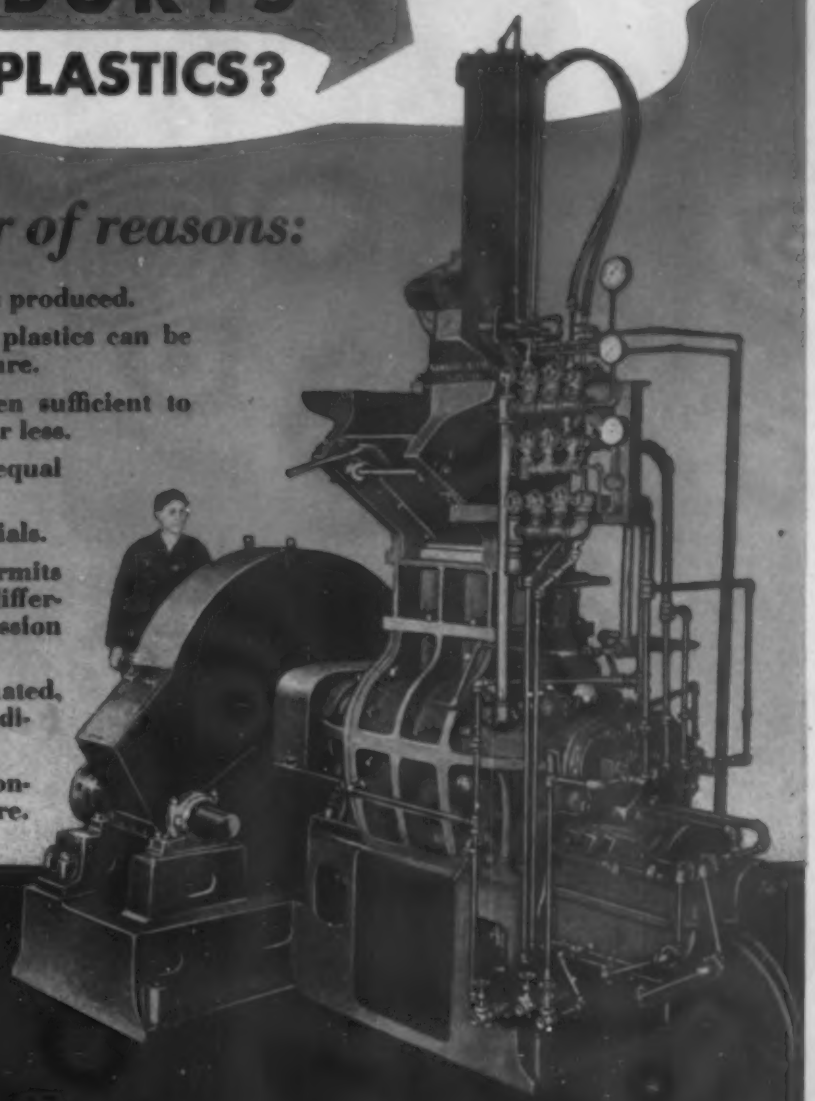
NEW YORK
31-28 Queens Blvd.
Long Island City, Zone 1

LOS ANGELES
5245 W. San Fernando Rd.
Zone 26

WHY DO SO MANY COMPANIES USE BANBURYS IN MIXING PLASTICS?

There are a number of reasons:

1. More uniformly mixed stocks are produced.
2. The heat necessary in handling plastics can be maintained at constant temperature.
3. Savings in production costs often sufficient to pay for an installation in a year or less.
4. Less floor space required for equal output.
5. More efficient handling of materials.
6. Self-cleaning mixing chamber permits processing a variety of stocks of different colors or formulas in succession without difficulty or delay.
7. Dust and fume hazards are eliminated, and safer, cleaner operating conditions provided for the worker.
8. Positive, automatic, mechanical control of the entire mixing procedure.



F-B PLASTICS MACHINERY

- Banbury Internal Mixers
- Roll Mills
- Converting, Mixing and Sheeting Rolls
- Calenders
- Extruding Machines
- Hydraulic Presses
- Hydraulic Accumulators
- Sheet Cutters or Planers

Banbury Mixers are available in nine sizes for laboratory or factory use. The sizes most generally used for plastics are the size 3A (shown above), having a batch capacity of 85 to 140 pounds, and the size 1, the batch capacity of which is from 24 to 40 pounds, depending upon the composition and specific gravity of the stock.

Write for complete details. Ask for a copy of our new bulletin, No. 180. No cost, no obligation.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.

Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles

Farrel-Birmingham

India Comes to America

Even mystic India, with its ancient traditions and ties with the past, recognizes the importance of plastics in the future scheme of things. Typical of the new generation of India now planning for its future is Muhammad Ali Azam, who has come half way 'round the world to study at the Plastics Institute.

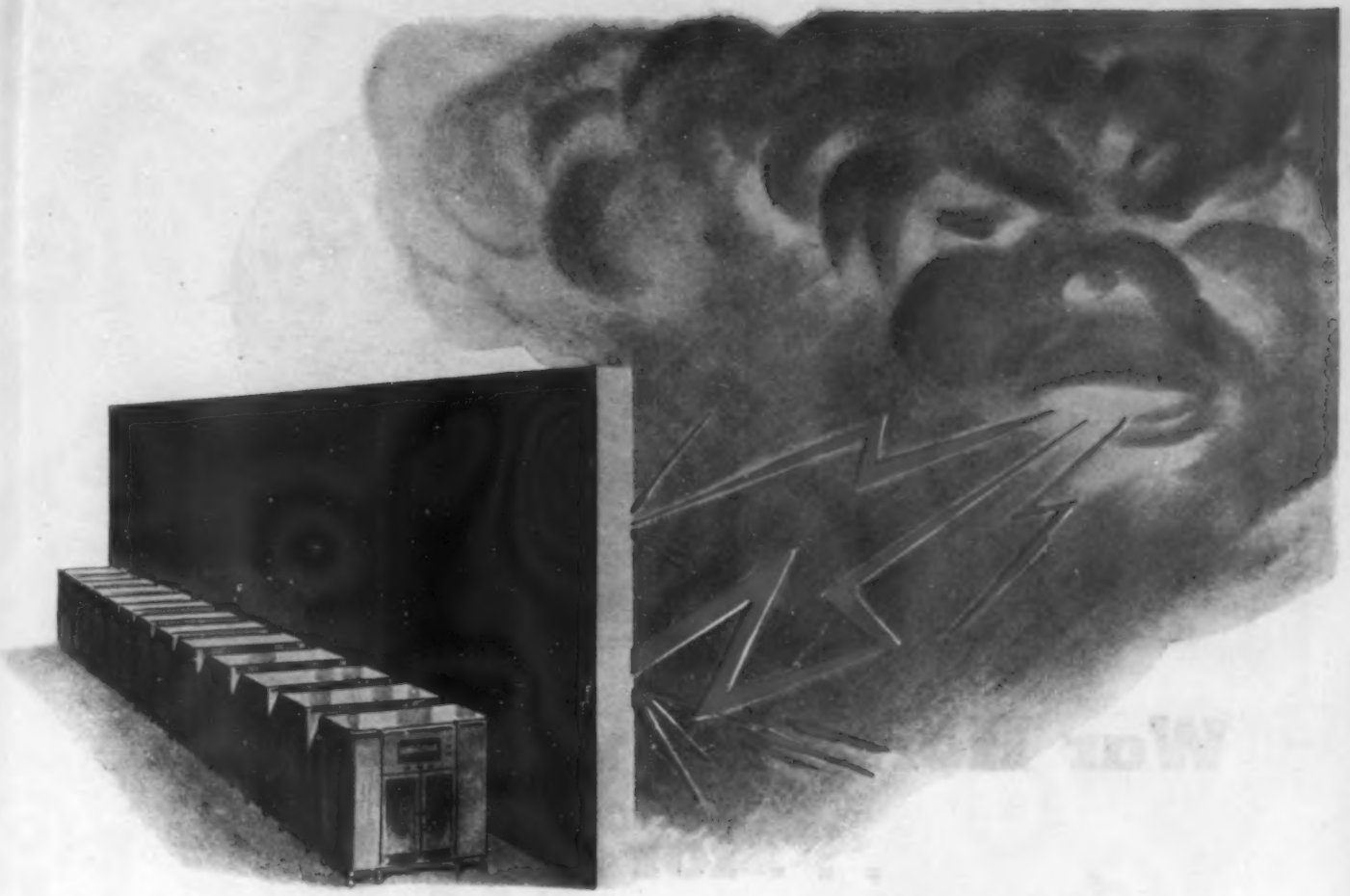
Naturally we are proud that men from many foreign countries come to the Plastics Institute to get the finest available technical training in this vital field. But we are just as proud of the many Americans studying with us and preparing to contribute their efforts toward the development of the plastics industry.

If any of your employees or anyone you know is interested in acquiring a basic knowledge of plastics, either by resident training or home study, your inquiry is welcome.

Plastics
INDUSTRIES TECHNICAL
INSTITUTE

Francis A. Gudger, President — John Delmonte, Technical Director

NEW YORK 17, N. Y., 122 EAST 42ND ST. * CHICAGO 1, ILL., 221 NORTH LASALLE ST. * LOS ANGELES 4, CALIF., 186 SOUTH ALVARADO ST.



ELECTRONIC SHIELDING

WITH PLATED PLASTICS . . .

● In radio and other electronic devices, metal plated plastics offer possibilities of many applications where a perfect shield from high frequency current is required. We invite electrical and electronic engineers to collaborate in developing new uses and methods of shielding with these versatile materials.

This is but one of the many allocations of Monroe metal plated plastics of various types which offer advantages in TENSILE STRENGTH, IMPACT STRENGTH, FLEXURAL STRENGTH . . . HIGH RESISTANCE TO HEAT AND COLD FLOW . . . INCREASED DIMENSIONAL STABILITY . . . RESISTANCE TO CORROSION . . . CONTROL OF ABSORPTION.

By the Monroe process, plastics can be successfully plated with any metal that lends itself to electroplating. These plated plastics are recommended for many uses where a genuine advantage over metals is established.

Designers and engineers are invited to investigate collaboration facilities offered for research in their specific fields of manufacture. Write for our bulletin giving you further information, Bulletin No. One on "PLATED PLASTICS."

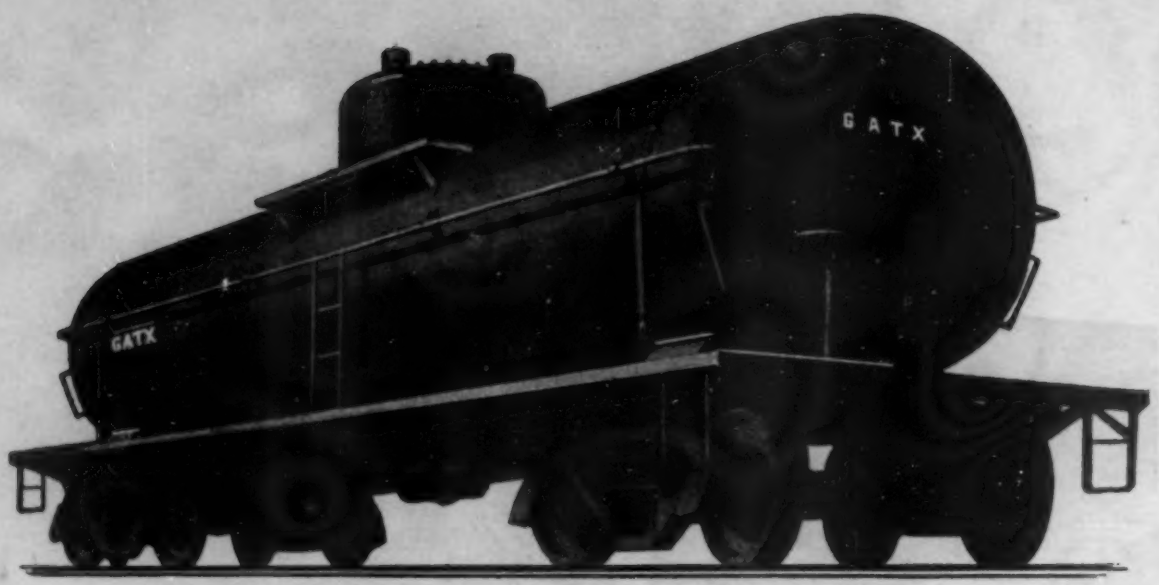
WHEN YOU THINK OF METAL PLATED PLASTICS, THINK OF—

The Metaplast Process

MONROE AUTO EQUIPMENT COMPANY

PLASTICS DIVISION

MONROE, MICH.



War Horse . . . with a Future . . . for You

FOR YOUR
POSTWAR PRODUCTS

General American engineers are ready now to consult with you—to plan new tank cars with every feature needed to transport your new products safely. Call or write our main office—135 South LaSalle St., Chicago 90, Ill.

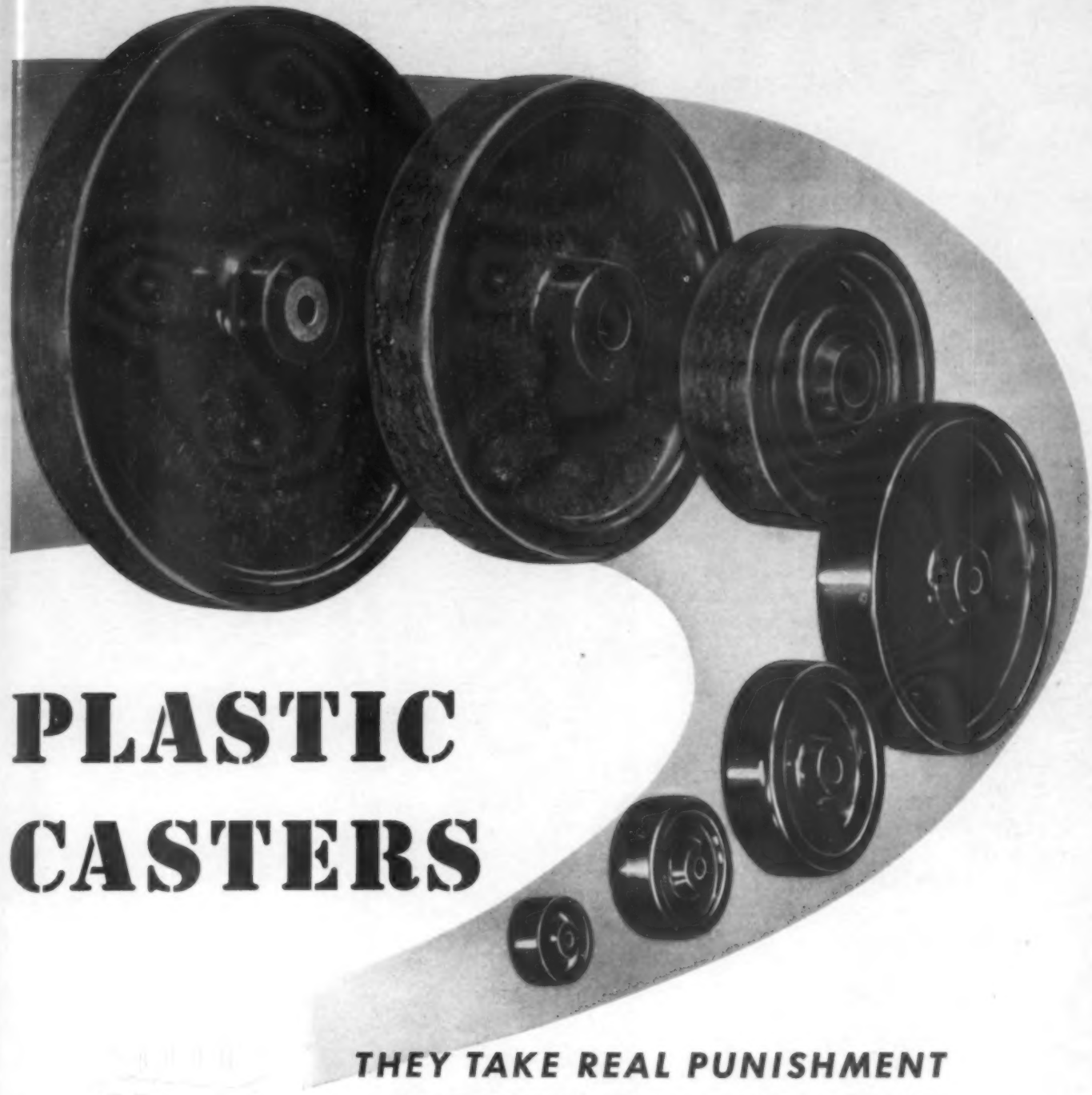
GATX
GENERAL AMERICAN

General American tank cars keep rolling these days. They speed gasolines for fighters; lubricants for industries; explosives, synthetics, edible oil, and many other war materials.

Their proven dependability and safety are important to you, planning for the years ahead. Your postwar products—liquid or gas—may be "hard-to-handle", requiring new types of linings or coatings—special cars unknown today. We will design the highly specialized cars you need—and build into them the proven reliability of all General American tank cars.

GENERAL AMERICAN TRANSPORTATION CORPORATION

Builders and Operators of Specialized Railroad Freight Cars ★ Bulk Liquid Storage Terminals ★ Pressure Vessels and other Welded Equipment ★ Aerocoach Motor Coaches ★ Process Equipment of all kinds ★ Fruit and Vegetable Precooling Service



PLASTIC CASTERS

THEY TAKE REAL PUNISHMENT ...BUT THEY DON'T DISH IT OUT!

When it comes to carrying the load, these plastic truck casters will stand right up to the metal wheels which they are rapidly replacing. In fact, the natural resiliency of this material withstands shock even better than metal. By the same token, they don't punish the floors like unyielding metal.

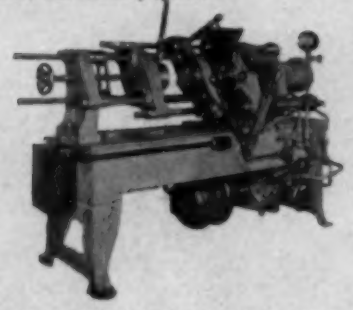
Plastic casters have other important advantages. For one thing, they are quiet . . . help to silence the chatter of trucking. And they are ready to use just the way they come out of the mold. No machining or other finishing operations are needed. Where chemicals are encountered, they resist acids, alkalis and most solvents.

Yes, plastics is a "natural" for casters. But the production of plastic casters calls for considerable skill to insure a uniform "cure" of the relatively thick sections. That's where the experience and know-how of MOLDED PRODUCTS comes in. Let us advise you in making your designs, or send us your specifications for quotation. MOLDED PRODUCTS COMPANY, 4533 W. Harrison St., Chicago (24) Ill.

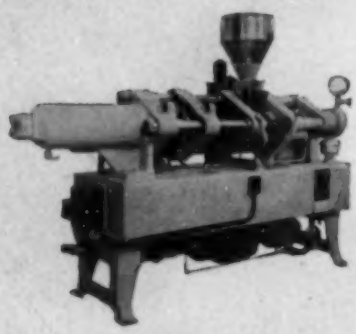
PLASTICS DIVISION

MOLDED PRODUCTS

The first "American made" injection molding machine for the plastics industry . . H-P-M built it in 1931. This machine was manually operated.

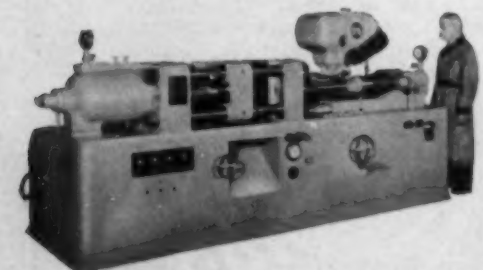


In 1934, H-P-M built the first injection molding machine incorporating an oil-hydraulic injection unit. The mold was manually clamped by a bayonet type lock.



In 1935, H-P-M built the first "all-hydraulic" injection molding machine. Both injection and mold clamp actions were hydraulically operated.

Many improvements, including greater production capacity, were incorporated in this "streamlined" H-P-M injection molding machine built in 1937



More improvements, including four rod guiding of clamp platen, were incorporated in this H-P-M injection molding machine. Recently equipped with a new material heating chamber (with electric band heaters) this machine is being currently offered in both four and nine ounce capacities.

13 YEARS OF *New H-P-M*

H-P-M's thirteen years of experience in designing and building plastics injection molding machines are represented in this new sixteen ounce capacity machine. A self-contained unit, with "all-hydraulic" operation, the 350-H-16 will answer the ever increasing need for larger capacity machines for production molding of thermo-plastic parts.

Professionally styled, the H-P-M 350-H-16 will enhance the appearance of any molding plant. Its simplicity of operation and control are outstanding. The H-P-M straight line hydraulic mold clamp provides positive sealing of mold, rapid die change-over, automatic slow-down and many other features.

OF EXPERIENCE ARE REPRESENTED IN THIS

M Injection Molding Machine

The newly designed material heating chamber, equipped with electric band heaters, guarantees ample plasticizing capacity with accurate zone heat control. New gravity type material feed is simple and positive.

H-P-M injection molding machines are powered by the reliable H-P-M oil-hydraulic operating system. Each pump, valve and control is designed and built by H-P-M, especially for heavy duty molding service. This unity of origin and manufacture of both operating equipment and machine not only assure coordinated functioning, but also undivided responsibility to the user. Write for Bulletin 4405 describing this 16 ounce H-P-M injection machine.

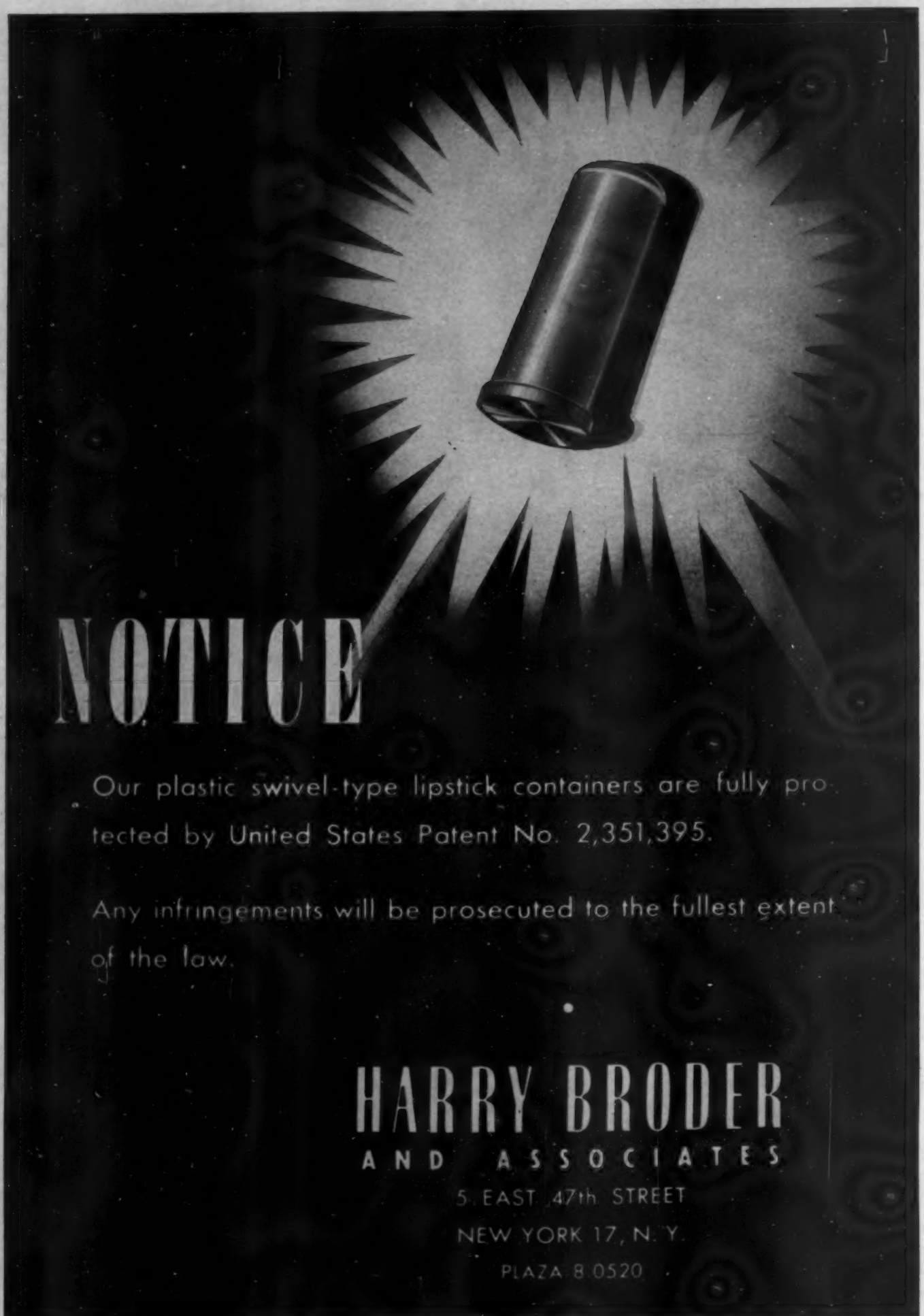
HPM

"all-Hydraulic" PLASTICS MOLDING MACHINES

THE HYDRAULIC PRESS MFG. COMPANY

Mount Gilead, Ohio, U. S. A.

District Sales Offices: New York, Syracuse, Detroit, and Chicago. Representatives in Principal Cities.


NOTICE
Our plastic swivel-type lipstick containers are fully protected by United States Patent No. 2,351,395.
Any infringements will be prosecuted to the fullest extent of the law.
HARRY BRODER
AND ASSOCIATES
5 EAST 47th STREET
NEW YORK 17, N. Y.
PLAZA 8-0520

Vinylite

TRADE-MARK

THIS NEW UPHOLSTERY MATERIAL

had a taxicab for a proving ground

A new VINYLITE Plastic upholstery material that was developed in time to find useful service on jeeps, 'planes, and tanks, was installed in a taxicab, before the war, to test its durability. The taxicab was an excellent proving ground. The illustration below shows the driver's seat, covered with the new VINYLITE Plastic material, just as it appeared after a hundred thousand miles of hard driving. Cab drivers do not spare the upholstery they ride on, yet the seat still looks newly-upholstered.

The answer is the VINYLITE Resin Compound calendered on the upholstery cloth. It is a rubber-like plastic that makes possible upholstery materials that do not oxidize, therefore will not crack upon aging. This new type upholstery possesses remarkable wear and abrasion resistance. Grease does not soil it; soiling is no longer a problem, because it can be wiped clean easily with a damp cloth. And it can be produced in a range of colors, in many unusual surface effects, and in natural leather grains.

The greater wear resistance and durability that VINYLITE Resin Compounds impart to upholstery for today's essential equipment will some day be applied to home and office furniture, motor cars, marine pleasure craft, and other peacetime products. For technical assistance and more detailed information, please write Department 7.

Plastics Division

CARBIDE AND CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

UCC

30 EAST 42ND STREET, NEW YORK 17, N.Y.

Photo courtesy Chicago Molded Products Corp. Operation: Removing flash from narrow apertures. The 6" Nicholson Warding Bastard proved to be "The right file for the job." On irregular edges, No. 0 and No. 2 Nicholson X.F. Swiss Pattern Crossing files are used. Six-inch Round, Half Round and Square files are also used.

NAME THE JOB—WE'LL NAME THE FILE

NICHOLSON engineers are making a continuing study of files for the plastics industry. And the deeper the study, the clearer has become the importance of using *The right file for the job.*

The shape and the size of the file needed for a specific operation are usually self-determined . . . by the contour, area and accessibility of the surface to be filed.

The coarseness of the cut is determined principally by the amount of material to be removed and the kind of finish the operation is to leave.

But it is in the *character* of the file cut that Nicholson engineering makes several important contributions toward production speed and efficiency in plastics filing:

In the main, files for plastics should have *high, thin-topped teeth*—in order that they may retain a good cutting edge even as they wear down under the peculiar abrasive action of most thermoplastics. Also, the gullets between the teeth should be wider than average—to enable the file to clear itself more readily, especially if the material is of a "shreddy" nature.

In addition to a range of Flat, Mill, Square, Round, Half Round, Three Square and Pillar, Nicholson Files for plastics now include a Milled Curvetooth type of improved design and amazing "razor" sharpness. Several types of X. F. Swiss Pattern files also are recommended (see mention of some in illustration legend above).

For cheerful help in the solution of any special plastics filing problem, send us the essential details. For the purchase of Nicholson or Black Diamond Files, contact your mill-supply house.

FREE — 48-PAGE BOOK, *"FILE FILOSOPHY."* Illustrates and describes scores of regular and special purpose files. Invaluable to purchasing and production heads, foremen, tool-shop mechanics.

NICHOLSON FILE CO. • 44 ACORN STREET • PROVIDENCE 1, RHODE ISLAND, U. S. A.

(Also Canadian Plant, Port Hope, Ont.)

√BLACK √BLACKER √BLACKEST

Carbon Pigments

COLOR BLACKS

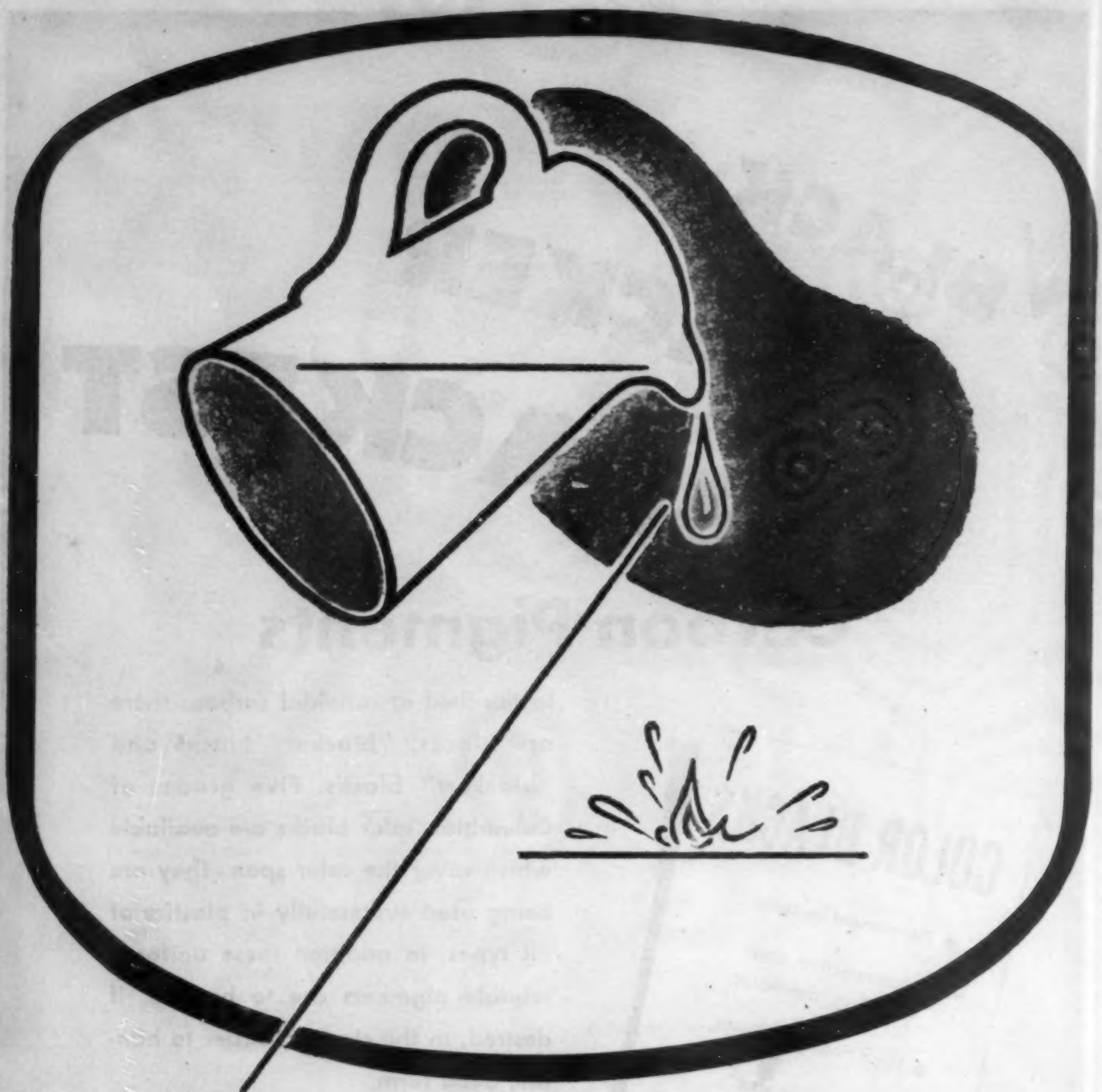
- Permanent in color.
- Non-reactive, non-bleeding, non-toxic.
- High tinting strength.
- Fine particle size.

In the field of colloidal carbons there are blacks, "blacker" blacks and "blackest" blacks. Five grades of Columbian color blacks are available which cover the color span. They are being used successfully in plastics of all types. In addition these uniform, reliable pigments are to be had, if desired, in the cleaner, easier to handle, bead form.

We invite technical inquiry and will gladly send samples

COLUMBIAN COLLOIDS

COLUMBIAN CARBON CO. MANUFACTURER • **BINNEY & SMITH CO.** DISTRIBUTOR



DO YOU BELIEVE A WATER-DISPERSED MATERIAL MIGHT ANSWER YOUR PROBLEM?

We disperse synthetic rubbers, resins, gums and many other rubber-like materials in water. Let us know your requirements and we probably can develop a water-dispersed elastomer or composition that will meet your particular need.

Dispersions Process, Inc.

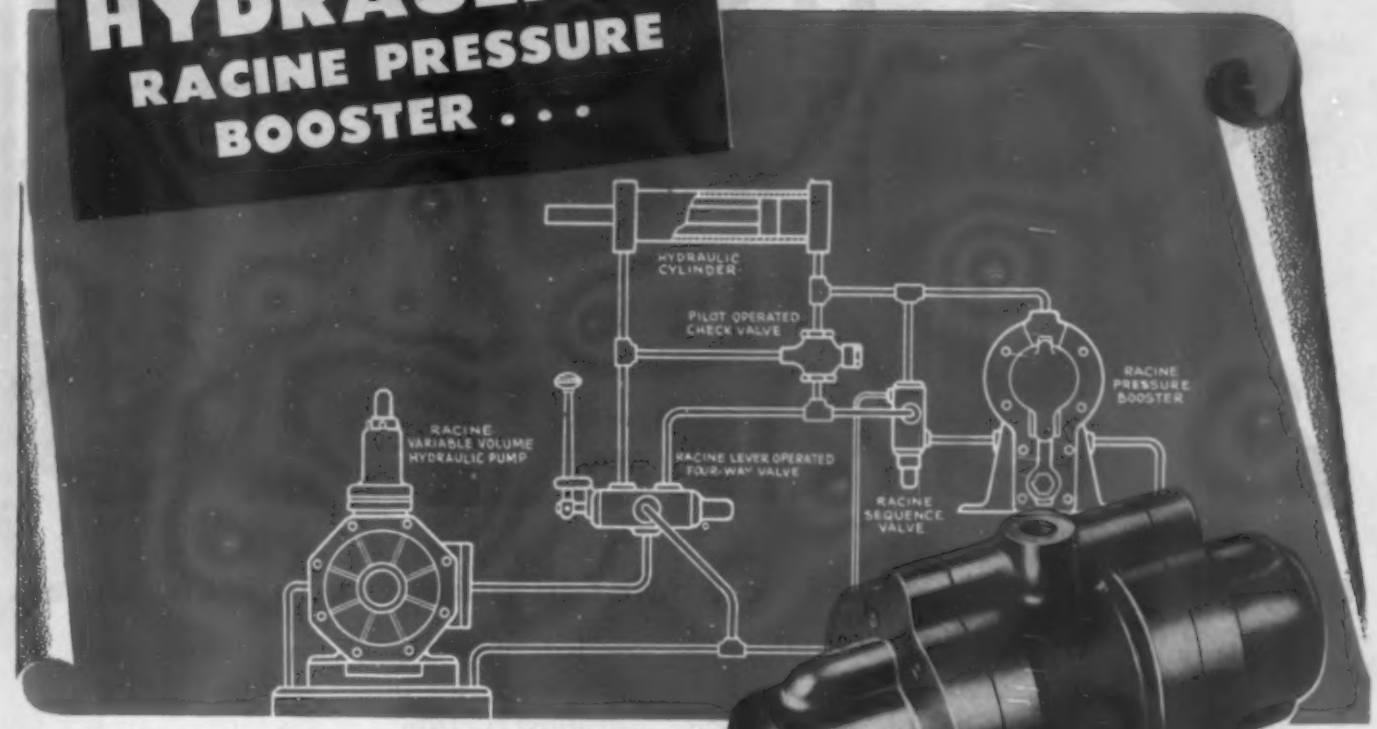
under management UNITED STATES RUBBER COMPANY

symbolizing research and development in water dispersions

US

1230 SIXTH AVENUE, NEW YORK 20, N. Y.

HYDRAULICS! RACINE PRESSURE BOOSTER . . .



★REPLACES HIGH PRESSURE PUMP

★PERMITS USE OF YOUR PRESENT PUMP AND MOTOR

★CUTS OPERATING COSTS

★COMPACT, SIMPLE, LEAK-PROOF CONSTRUCTION

Fits anywhere into your present or new hydraulic circuits without interference. *Now you can obtain high pressure when you need it*—return to low pressure at will Use low horsepower motor and low pressure control valves—results in lower initial investment and reduced operating and maintenance costs.

Racine Pressure Boosters can be used in circuits having either variable or constant volume pumps to produce a constant or variable high pressure hydraulic service. Free from repairs —no gears to wear out — no driving mechanism to get out of adjustment. An exclusive Racine patented unit.

Racine Offers a Complete Hydraulic Circuit Service

Racine "Variable Volume" Oil Hydraulic Pumps assure greater flexibility and smoother operation of your hydraulic circuits. They reduce oil heating and pump only the amount of oil necessary to do the job—no waste of oil or horsepower No relief or by-pass valves are required. Pumps in capacities of 12-20-30 G.P.M. Operating pressures 50 to 1000 lbs. p.s.i. Also available is a complete line of valves for the control of hydraulic circuits Sizes ⅜" to 1½". Write today for complete Catalog No. P-10-C. Address Dept. MP-P.

RACINE HYDRAULIC METAL CUTTING MACHINES

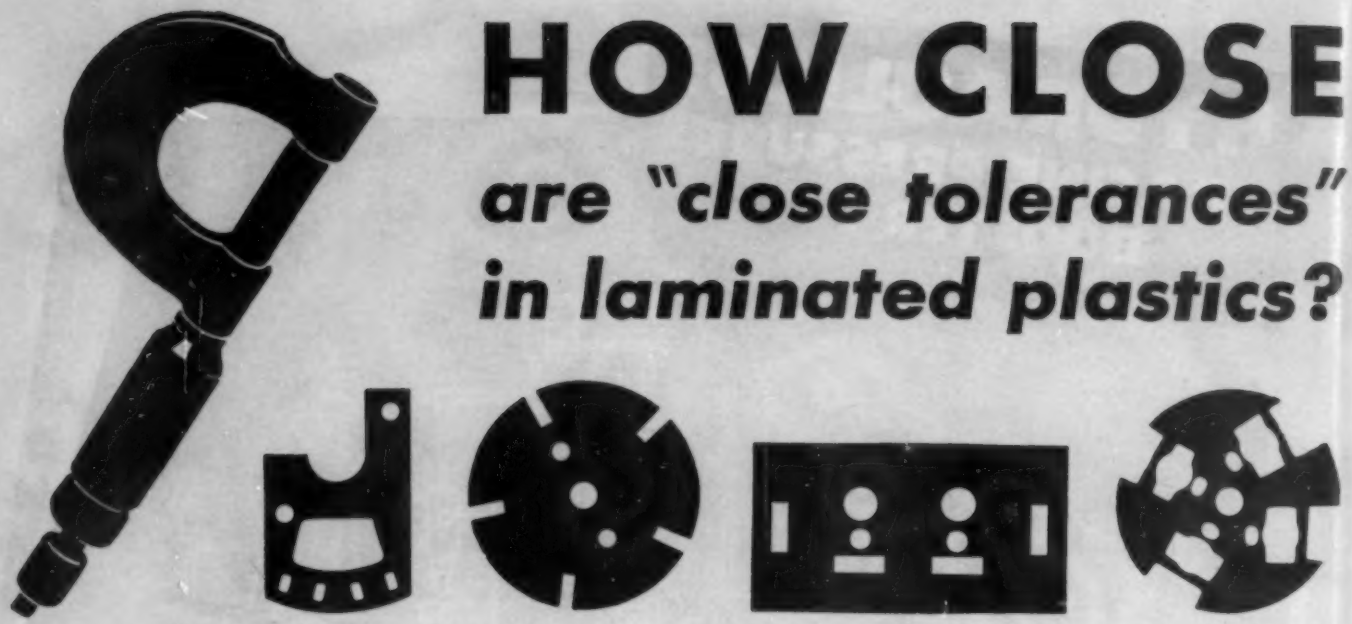
The Production Saws of Modern Industry

A complete line of Metal Cutting Saws in a wide range of styles and prices. Capacities 6" x 6" to 20" x 20".

Racine Metal Cutting Saws feature hydraulic control of blade feed and pressure, for cutting the complete list of metals from soft aluminum tubing to hard alloy tool steels. Models are available with Automatic Stock Feed for high production, one man operation.

The Racine Metal Saw of today is the outcome of 36 years of pioneering in metal saw design and construction. For fast and accurate metal cutting with long blade life a Racine Saw is a wise and economical investment. Complete details supplied on request. Ask for Catalog No. 12.

RACINE
TOOL and MACHINE COMPANY
Standard for Quality and Precision
RACINE, WISCONSIN, U. S. A.



HOW CLOSE *are "close tolerances" in laminated plastics?*

Ultimate "close tolerances" on holes in parts made from sheets

Exercising extreme care in the making of tools, and in the machining of the material; and with close individual inspection of finished parts, the following tolerances may be achieved when drilling or punching holes in Dilecto laminated plastics. These are, however, the "ultimate" close tolerances which the plastic nature of Dilecto will allow regardless of any further care or time which might be given to making of tools and fabrication. To hold these tolerances costs are increased substantially.

DIAMETER OF HOLE	DRILLING	*REAMING	PUNCHING** 1/16 STOCK	PUNCHING** 3/32 STOCK
Up to ¼"	−002 +003	−001 +001	−003 +003	−004 +004
¼" to ½"	−002 +003	−0015 +0015	−004 +004	−005 +005
½" to 1"	−002 +005	−002 +002	−005 +005	−007 +007
1" to 2"	−010 +010	−0025 +0025	−006 +006	−008 +008

*Reaming is not recommended as a general practice on Phenolics and never on holes running parallel to the laminations. Holes over 1" are bored.

**Allow .003" per inch on hole center distances for shrinkage due to necessity to heat stock.

FOR DESIGN ENGINEERS . . . PRODUCTION AND BUYING EXECUTIVES

- When ordering Dilecto laminated plastics to be fabricated in your own shop . . . give full details of the fabricating problem so the most suitable form and grade of Dilecto will be furnished . . . when fabricated parts are ordered, B/P's should first be submitted for study by C-D Engineers . . . who can often suggest modifications which will result in lower production and die costs . . . for complete design data send for bulletin FP.

DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C.
West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities

CX44

Continental - Diamond FIBRE COMPANY

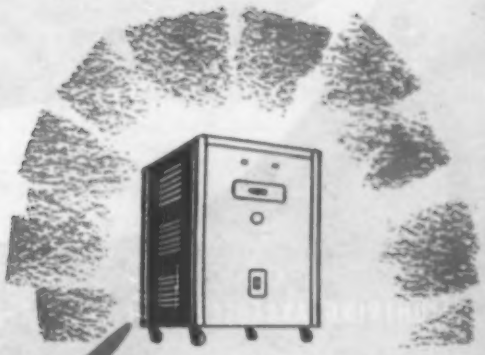
Established 1895. . Manufacturers of Laminated Plastics since 1911—NEWARK 28 • DELAWARE

Drastically Reduce

MOLDING PRESSURES and CLOSING TIME!

HEAT PREFORMS WITH THERMEX and you'll close dies with only 15% to 50% of the pressure ordinarily required. You'll minimize die breakage, press wear and power consumption. You'll handle much larger and more intricate moldings, on the same presses and with almost no spoilage. You'll fill molds in a tenth the time, which helps to slash time cycles and unit costs. You'll improve the strength and finish of your moldings. You'll be able to work a wider variety of plastics materials, too.

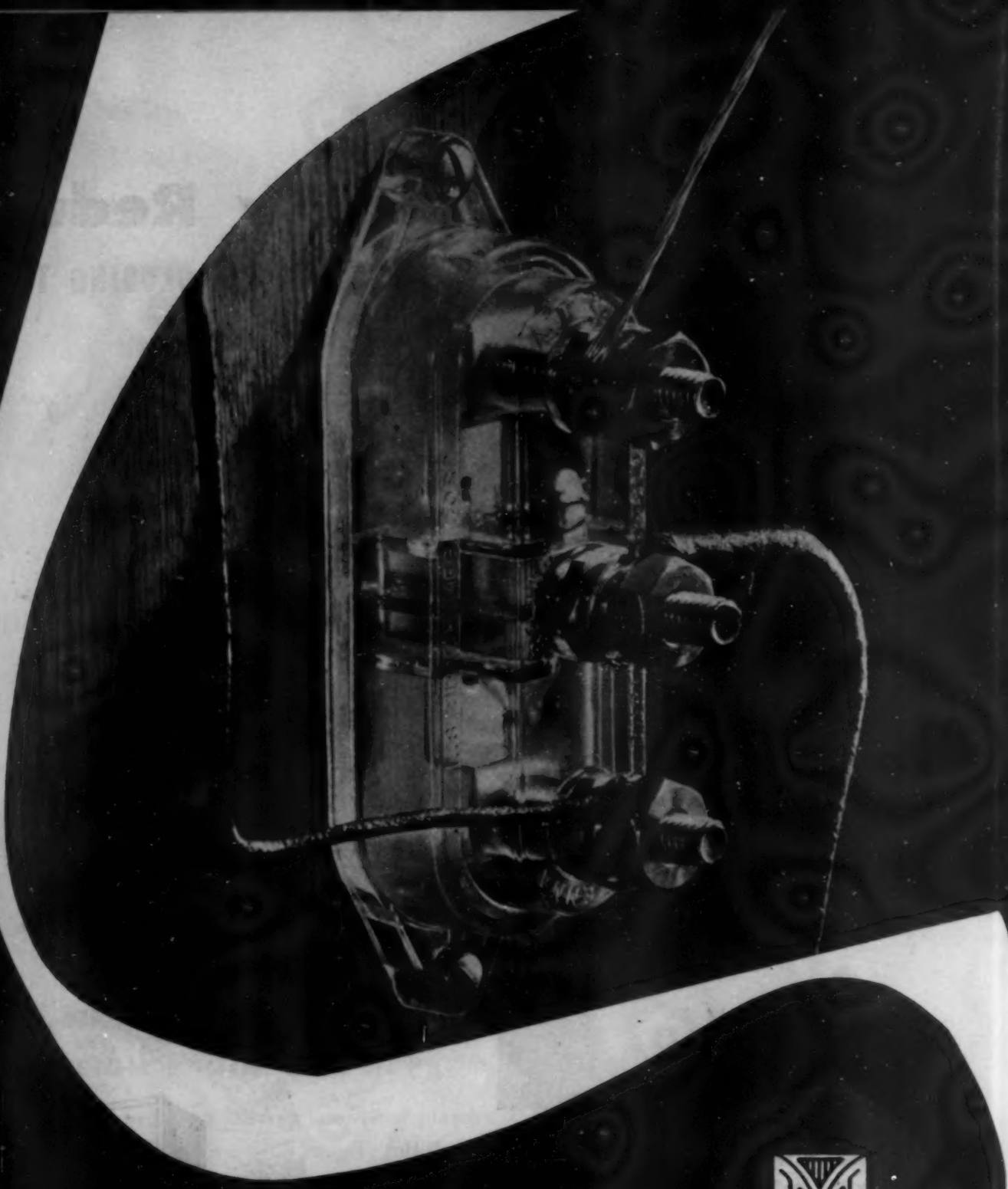
Thermex units with built-in preheating cabinet, as shown, are available in every capacity required for plastics work. They are fully automatic and require no tuning or specially trained operator. The Girdler Corporation, Thermex Division, Louisville 1, Ky.



Thermex

A GIRDLER PRODUCT

THE FIRST INDUSTRIAL HIGH FREQUENCY DIELECTRIC HEATING EQUIPMENT



LIGHTNING ARRESTER . . . of TENITE* — for BRACH† — by STERLING

Its purpose—to serve with the Signal Corps—to protect installations against serious damage. During thunderstorms, the glow of a small neon tube, visible through the transparent plastic, indicates that all's well between antenna and ground. All's well, too, with the functional simplicity of its design. Injection molded of Tenite, this housing can take extremes of weather, is lighter, less bulky than its glass predecessor and will not shatter. It exemplifies Sterling quality at work—embodies a know-how with plastics that promises like satisfaction to manufacturers faced with molding problems. Inquiries invited.

STERLING PLASTICS CO.

1140 COMMERCE AVENUE, UNION, N. J.

*An Eastman Plastic

†L. S. Brach Manufacturing Corp.

WHO ARE THE *Mosinee Paperologists?*

Mosinee Paperologists are engineers of paper...technicians experienced in creating "alloys" in paper to meet specifications, just as metallurgists produce metal alloys. Here at Mosinee these practical paper scientists are backed by modern laboratory and production facilities, with specialized controls of materials and processes. These are men capable of cooperating with product engineers to "make the most of paper". They know production procedure, how to speed output, reduce time and material losses, and lower costs in plants wherever paper is involved.

For instance, if a product or part requires high tensile strength, accurate density, precise caliper, specified dielectric strength, controlled maximum-minimum pH (acidity) or alkalinity, or many other specific characteristics within the realm of paper, Mosinee Paperologists not only can engineer these properties into paper, but also can aid efficient application of such paper to your production setup.

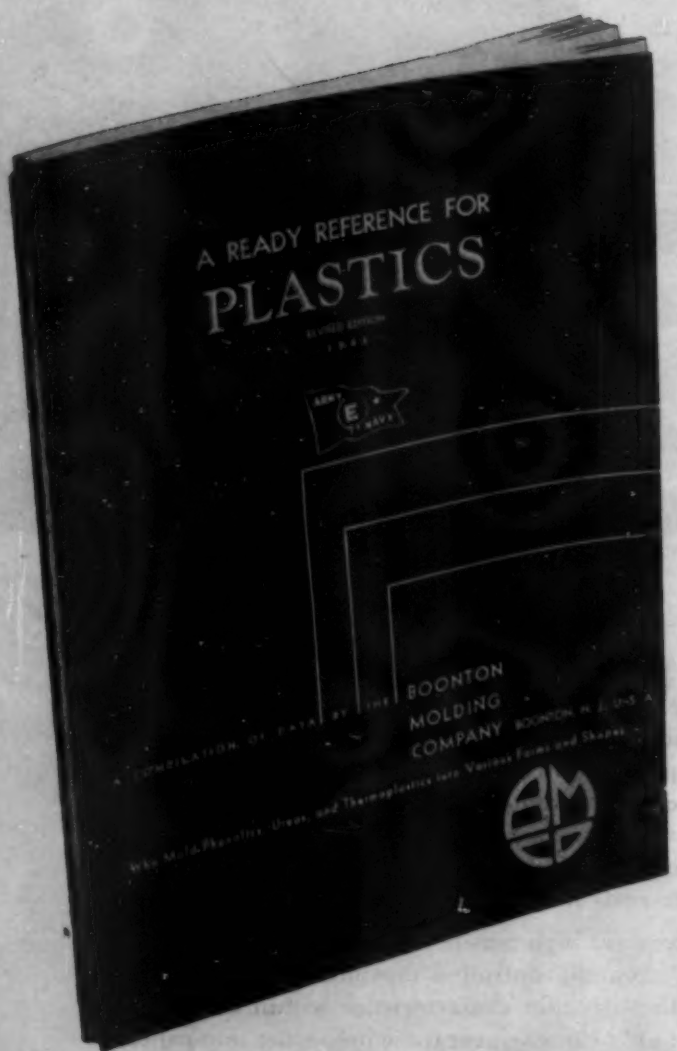
Mosinee Paperologists are ready to work on your present or postwar problems.

MOSINEE PAPER MILLS CO. MOSINEE WISCONSIN

Please address your letter "Attention Dept. A"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

May we sell you a copy of this book **FREE?**



After the low point in 1932, we felt so flush in 1933 that we decided to put out a catalog.

But our catalog had to be different—to reflect our own unique, sparkling personality.* So we threw away our mirror and got to work.

Instead of talking about ourselves, we decided to give the world a compendium of easy-to-assimilate information about plastics—what they are, where they come from, how they're molded, designed, etc.

Incidentally, we were making our own task a little easier because an informed customer presents us with less problems and difficulties. He has some idea of what can and what cannot be done.

Of course, a lot of people have read our book and then gone to some other molder, but why worry? The percentages are in our favor.

If you would like a copy of a "Ready Reference For Plastics" just write us a note on your letterhead. It's free to business executives and Government employees.

* Check this – where is it? GKS

ARMY E NAVY

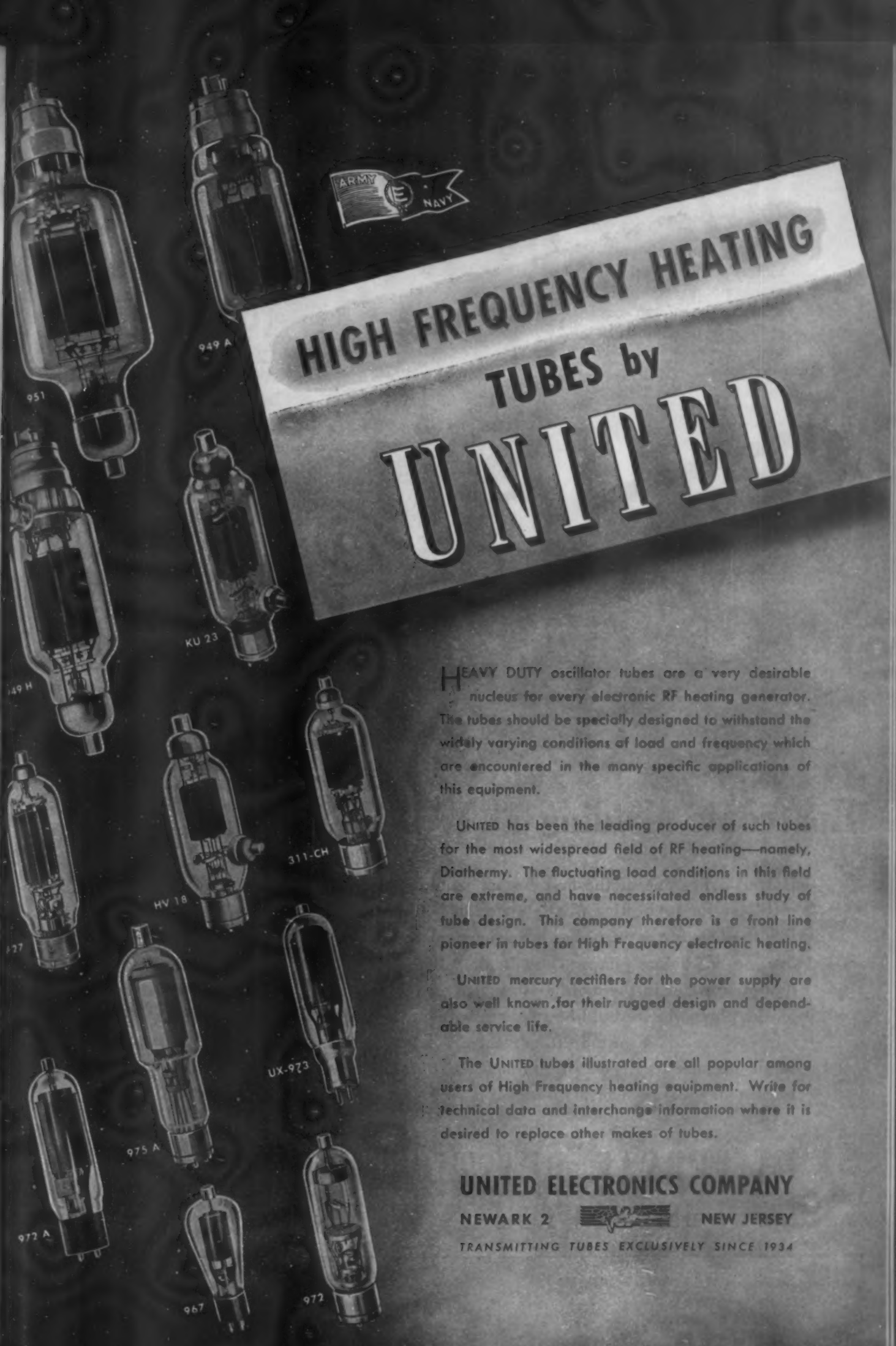
BOONTON MOLDING COMPANY

MOLDERS OF PLASTICS · PHENOLICS · UREAS · THERMO PLASTICS

BOONTON · NEW JERSEY · Tel. Boonton 8-2020

NEW YORK, OFFICE

Chanin Bldg., 122 East 42nd Street, New York 17, N. Y. MUrray Hill 6-8540



HEAVY DUTY oscillator tubes are a very desirable nucleus for every electronic RF heating generator. The tubes should be specially designed to withstand the widely varying conditions of load and frequency which are encountered in the many specific applications of this equipment.

UNITED has been the leading producer of such tubes for the most widespread field of RF heating—namely, Diathermy. The fluctuating load conditions in this field are extreme, and have necessitated endless study of tube design. This company therefore is a front line pioneer in tubes for High Frequency electronic heating.

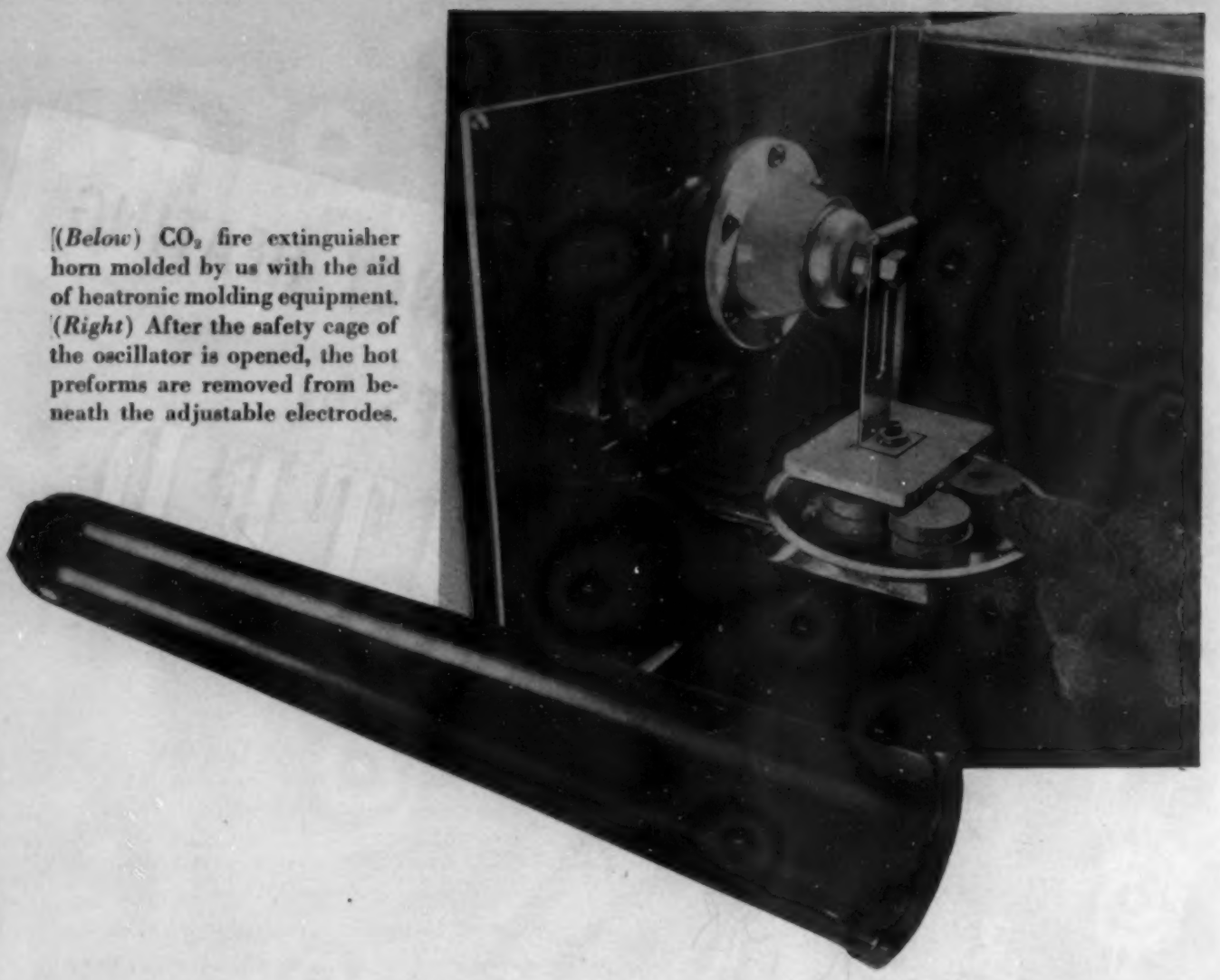
UNITED mercury rectifiers for the power supply are also well known for their rugged design and dependable service life.

The UNITED tubes illustrated are all popular among users of High Frequency heating equipment. Write for technical data and interchange information where it is desired to replace other makes of tubes.

UNITED ELECTRONICS COMPANY

NEWARK 2 NEW JERSEY

TRANSMITTING TUBES EXCLUSIVELY SINCE 1934



(*Below*) CO_2 fire extinguisher horn molded by us with the aid of heatronic molding equipment. (*Right*) After the safety cage of the oscillator is opened, the hot preforms are removed from beneath the adjustable electrodes.

Heatronic Molding at UNIVERSAL? *Certainly!*

Universal was one of the first custom molding plants to install a high-frequency oscillator for preheating plastic materials before molding. On difficult molding jobs like the CO_2 fire extinguisher horn shown above we preheat the preforms for thirty-five seconds before placing them in the cavities. The material, a phenolic plastic, flows like water in the mold and requires only a fraction of the forty tons pressure on the plugs which would be required without preheating. Heatronic molding minimizes rejects and insures uniform results. You may have a difficult molding job which would be solved satisfactorily through the application of heatronic molding. Get in touch today with Universal.

UNIVERSAL PLASTICS CORPORATION

NEW BRUNSWICK • NEW JERSEY

New York Office: New York 1, Empire State Building
Chicago 3: Steel Mill Products Co., Inc., 176 West Adams Street
Philadelphia 6: Paragon Sales Co., Inc., 402 Cherry Street
Detroit 2: June & Company, 719 New Center Building

ELMES PISTONLESS-TYPE, AIR-BALLASTED HYDRAULIC ACCUMULATOR

PATENTED. Modern, efficient, reliable . . . requires minimum floor space, no special foundation. Foolproof design and construction give a constant power flow under closer pressure regulation, and eliminate line shocks.

ELMES SIX-PLUNGER, HORIZONTAL, HIGH-PRESSURE PUMP

Motor driven, for heavy-duty service, pressure lubrication throughout; roller bearings; can be furnished with built-in unloader; capacity range, 100 h. p. to 500 h. p.

LOOK TO ELMES for Hydraulic Power TO SPEED PRODUCTION OF MOLDED PLASTICS

IN scores of busy plastic-molding plants, Elmes hydraulic equipment is speeding production of quality parts for a thousand different uses . . . keeping pace with today, keeping faith with tomorrow, in this fastest-growing industry in our age-of-change.

Now, it's a fight against time—against production interruptions, reject losses, wasted man-hours—yet Elmes presses, pumps, and pistonless accumulators can play an equally important part in the capacity *and cost* competition that lies ahead.

Elmes simplified controls for automatic-time-cycle press operation, with fast opening and closing speeds, controllable molding speed and variable curing time, assure high production efficiency while practically eliminating die breakage or damage. Elmes high-pressure pumps provide a dependable source of fluid power. Elmes air-ballasted accumulators deliver this fluid pressure smoothly, surely, without shock, for multiple-unit operation.

For nearly a century, Elmes has solved the hydraulic power problems of industry. Our staff of engineering specialists is at your service in suggesting or developing the equipment you should have for pre-peace and postwar production.

FREE BULLETINS ON ELMES HYDRAULIC PRESSES, PUMPS AND ACCUMULATORS

These three Elmes bulletins are yours for the asking: Bulletin No. 5000, "Hydraulic Plastic Molding Presses," covers briefly the subject of compression and transfer molding processes, explaining the three types of presses generally used, their controls, etc. Bulletin No. 1020, "Elmes High-Pressure Pumps," describes and illustrates the wide range of Elmes standard models. Bulletin No. 5100, "Elmes Pistonless-Type Air-Ballasted Hydraulic Accumulators," shows internal construction; why line-shock is impossible; how automatic protection controls function. Write for these bulletins today.

ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES, 225 N. Morgan St., Chicago 7, Illinois

ELMES HYDRAULIC EQUIPMENT

Also Manufactured in Canada

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

INCREASE your 'VIEWPOINT' to

those formerly inaccessible places

This cleverly designed inspection mirror 'reflects' those inaccessible places. Sturdily constructed, weighing one ounce, this tool is a real aid to inspectors.

Designed and molded for one of the largest companies in the world today, it is an outstanding example of how the Plastic Division of Metal Specialty serves its clients.

We welcome the opportunity to serve you.

MAIN OFFICE — PLANT
Este Ave. • Cincinnati 32 • Ohio

BRANCH PLANT — SALES OFFICE
South L Street • Richmond • Ind.

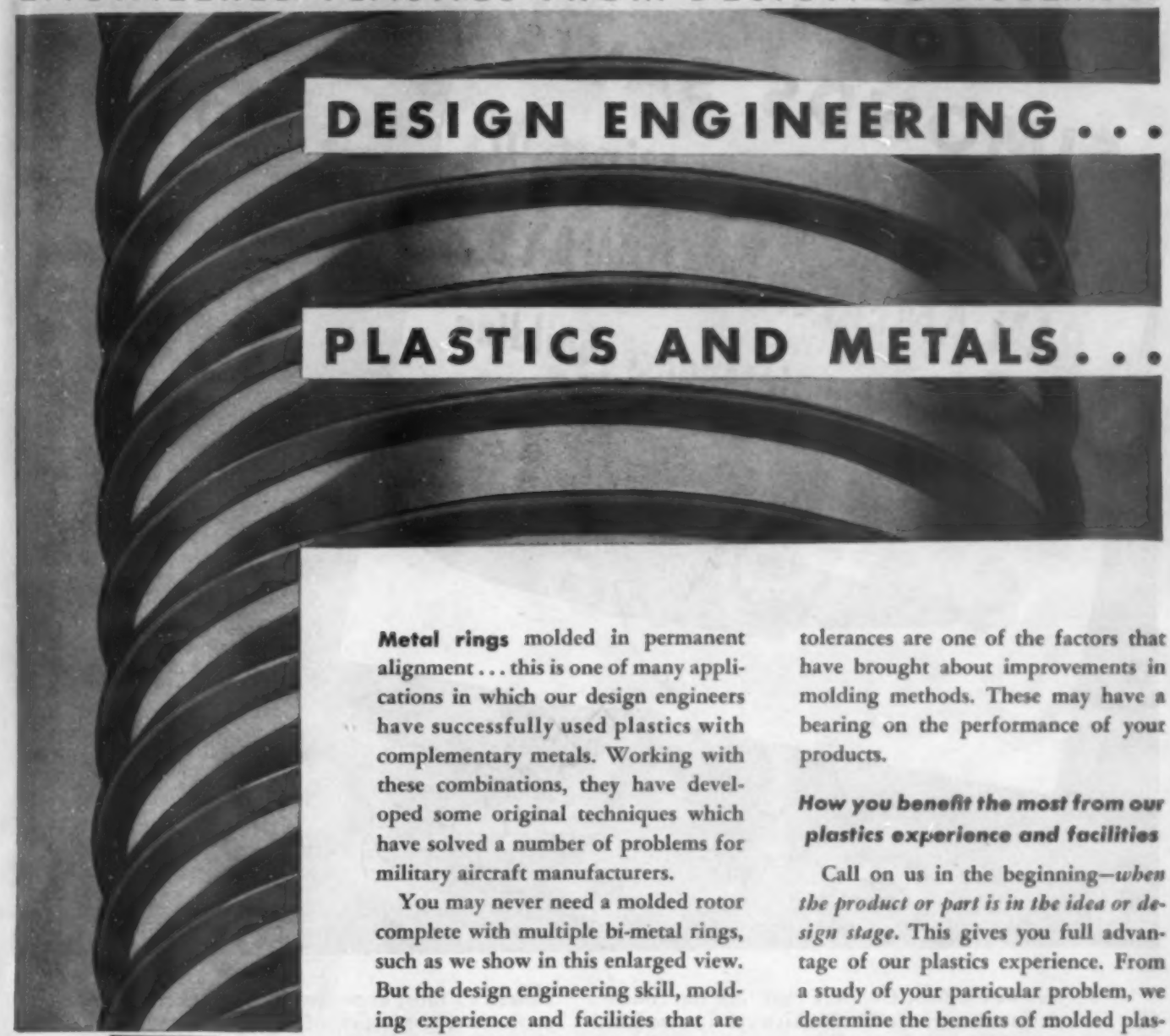
SALES OFFICE
W. Grand Blvd. • Detroit • Mich.

ARMY E NAVY

The METAL SPECIALTY Co.
MAIN OFFICE AND PLANT • ESTE AVENUE • CINCINNATI OHIO

PLASTIC DIVISION

ENGINEERED PLASTICS FROM DESIGN TO ASSEMBLY



DESIGN ENGINEERING . . .

PLASTICS AND METALS . . .

Metal rings molded in permanent alignment . . . this is one of many applications in which our design engineers have successfully used plastics with complementary metals. Working with these combinations, they have developed some original techniques which have solved a number of problems for military aircraft manufacturers.

You may never need a molded rotor complete with multiple bi-metal rings, such as we show in this enlarged view. But the design engineering skill, molding experience and facilities that are required for the volume production of such an item might be used to benefit your products — products to be produced for war requirements and/or in the planning stage for postwar promotion.

Regardless of how you may have considered plastics in the past, it is in your interest now to reconsider them for the possibility of new applications. Military requirements for rigidly held tolerances are one of the factors that have brought about improvements in molding methods. These may have a bearing on the performance of your products.

How you benefit the most from our plastics experience and facilities

Call on us in the beginning—*when the product or part is in the idea or design stage.* This gives you full advantage of our plastics experience. From a study of your particular problem, we determine the benefits of molded plastics for the job at hand. Our engineers help in the design development. From the many kinds of plastic materials, we select those that have the desired properties for the specific application and molding process. Calling on us early, you are assured of the right use of plastics and of a design that permits maximum manufacturing efficiency. Write for free copy of Folder File, outlining and illustrating our services.

PM

THE SYMBOL OF
ENGINEERING EXPERIENCE
AND MOLDING SKILL

REPRESENTATIVES

DETROIT 2
905-08 NEW CENTER BLDG.

•

NEW YORK 1
19 W. 34TH ST.

•

LOS ANGELES 35
1440 SO. ROBERTSON BLVD.

•

CANADA
A. & M. ACCESSORIES LTD.
19 MELINDA ST., TORONTO
744 W. HASTINGS ST.
VANCOUVER
1405 BISHOP ST., MONTREAL

PLASTIC MANUFACTURERS

INCORPORATED

STAMFORD, CONNECTICUT

MOLD MAKING • INJECTION & TRANSFER MOLDING • COMPLETE ASSEMBLY

SIMONDS SAWS speed plastic-cutting in PAN AMERICAN AIRWAYS' new Miami maintenance building

To service the fleet Clippers that link the continents, Pan American World Airways System has completed its largest maintenance building, covering 2½ acres west of the Miami passenger terminal.

Here, where 12 to 18 planes can be serviced at one time, speed is vital on all work. So Simonds Circular Saws are used on many operations like the one shown . . . in which a 10" high speed saw is cutting sheet plastic which goes into everything from radio dials to cabin windows.

America's most experienced saw-makers produce tools to cut plastics of all types . . . and to cut them faster, smoother, straighter, with longer operating intervals between grinds. Have your Industrial Supply Distributor bring a Simonds engineer to take a quick, first-hand look at your cutting operations *{no long-drawn-out paper survey}* . . . and see what he can do to help you increase production and increase the life of your cutting tools. Get in touch with your dealer *today.*

SHORTEN THE WAR **BUY BONDS!**

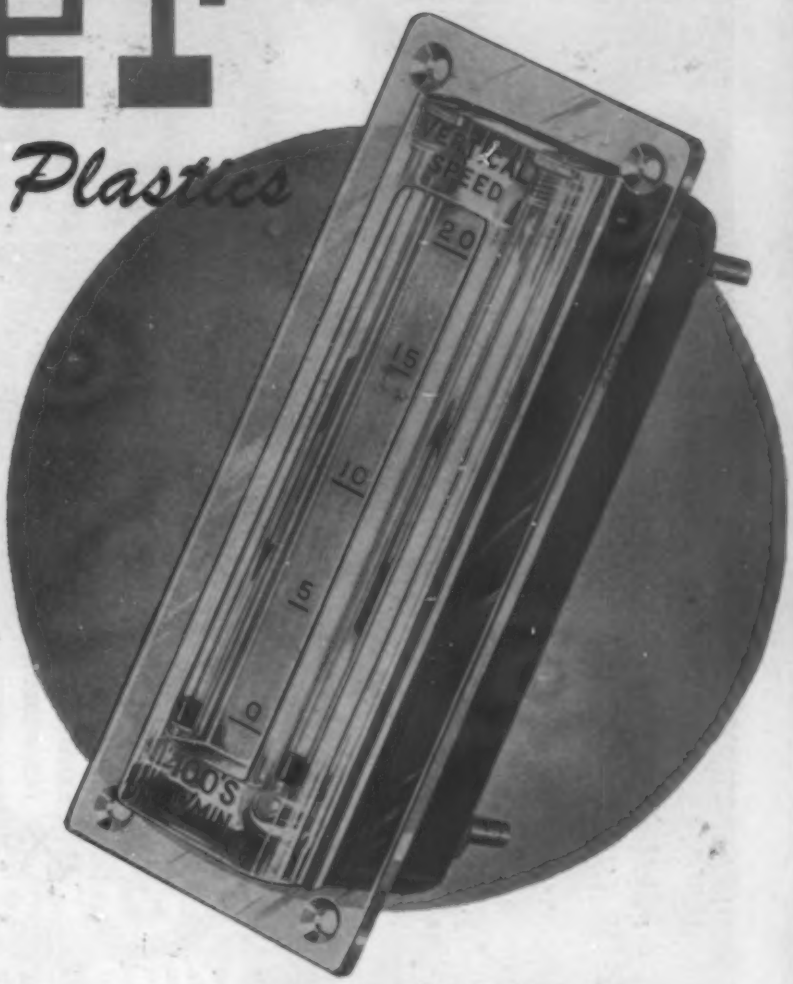
BRANCH OFFICES
1950 Columbia Road, Boston—27, Mass.; 127 S. Green St., Chicago—7, Ill.; 228 First Ave., San Francisco—5, Calif.; 311 S. W. First Ave., Portland—4, Ore.; 520 First Ave. So., Seattle—4, Wn.; 31 W. Trent Ave., Spokane—8, Wn.

SIMONDS SAW AND STEEL COMPANY
FITCHBURG, MASSACHUSETTS

PRODUCTION TOOLS FOR CUTTING METAL, WOOD, PAPER, PLASTICS

Cruver

A Great Name in Plastics



UP and DOWN in PLASTICS

This very unusual molding job creates a precision instrument for determining rate of climb and descent in aircraft through unusual close tolerance molding. Actual saving in money is $40.00 per instrument against former construction.

Front part is injection molded of acrylic with special cores achieved through use of core cams only ⅛" thick and 4" long. Precision Molded Styrene pellets fit within these cores with just enough clearance to allow a very slow flow of air. Back piece is molded of acetate.

Cruver does complete assembly as well, utilizing brass parts, rubber tubing, metal accumulator.

The unusual accuracy of this instrument presages big things for Cruver's molding customers post-war. Our comprehensive assembly department offers a unique facility in plastics manufacturing.

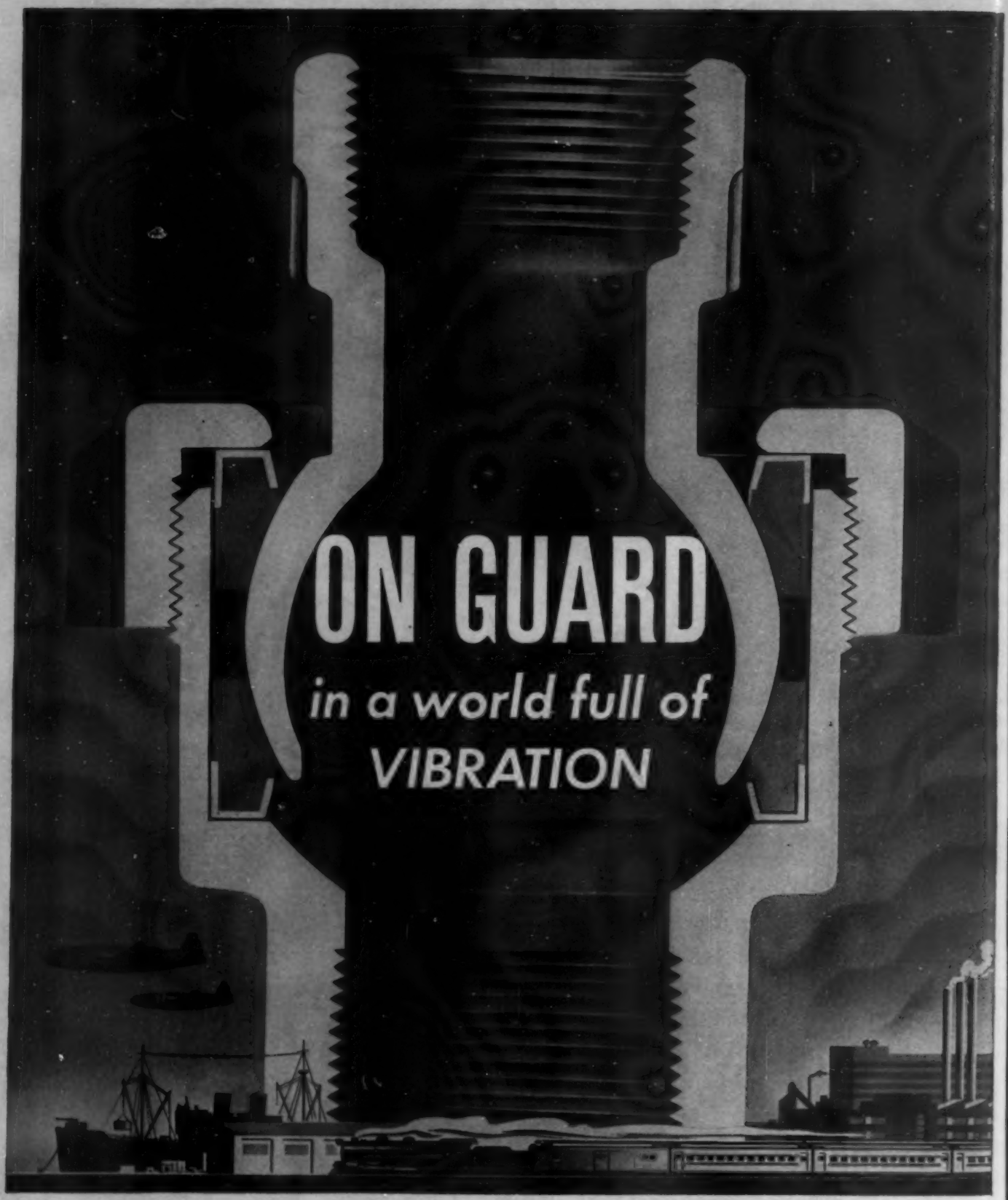
Cruver

MANUFACTURING COMPANY

NEW YORK
2 West 46th St.
Wisconsin 7-8047

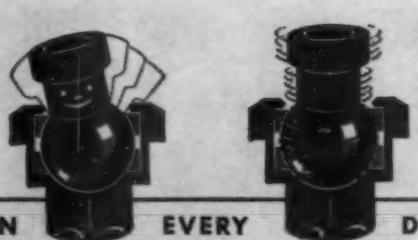
CHICAGO
2456 W. JACKSON BLVD.
Seeley 1000

WASHINGTON
Hotel Washington
Met. 5-900, Ext. 650



BARCO FLEXIBLE JOINTS

BARCO MANUFACTURING CO., NOT INC.
1809 WINNEMAC AVE., CHICAGO 40, ILL.
In Canada: THE HOLDEN CO., LTD., MONTREAL, CANADA



Not just a swivel joint ...but a combination of a swivel and ball joint with rotary motion and responsive movement through every angle.

"MOVE IN EVERY DIRECTION"

Here's Double-Barreled Good News for Plastics Manufacturers!

Supplies are up!

DU PONT FORMALDEHYDE

U. S. P. SOLUTION

Prices are down!

The General Price Reduction, announced May 6, 1944, is consistent with the Du Pont policy of passing on to its customers economies which result from more efficient manufacturing operations.

Prompt Shipments can now be made from adequate stocks at the factory and in principal cities. Expanded production and additions to our tank car fleet enable us to make deliveries in any commercial quantity.

You Need Dependable Quality for faster, more efficient production. Specify Du Pont Formaldehyde, and get the advantages of these properties:

UNIFORM STRENGTH—Removes much of the uncertainty regarding yields and quality of the finished product.

HIGH PURITY—Simplifies consistent production of products possessing unvarying properties.

WATER-WHITE COLOR—Permits production of clear, white or delicately tinted materials.

LOW ACIDITY—Minimizes corrosion of apparatus; simplifies control of reactions.

* * *

Information and technical assistance on the use and handling of this material are available from the Electrochemicals Dept., E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.

District Offices: Baltimore, Charlotte, Chicago, Cleveland, Kansas City, Boston, New York, Philadelphia, San Francisco*
**Barada & Page, Inc*

Also available

PARAFORMALDEHYDE

POWDERED *or* **GRANULAR**

Minimum Strength 95%

HEXAMETHYLENETETRAMINE

U.S.P. Crystals and Technical

* * *

SMALL ORDERS CAN BE FILLED WITHOUT WPB APPLICATION

Effective April 6, Allocation Order M-25 has been revoked and Formaldehyde placed under General Allocation Order M-300 as in appendix A material subject to Schedule 9. The new order still permits purchases under "Small Order Exemption" of quantities up to 10,000 lb. of Formaldehyde, 3,000 lb. of Paraformaldehyde and 10,000 lb. of Hexamethylenetramine in any calendar month. These quantities can be obtained without application. Quantities in excess of the above still require application on Form WPM-2945 (PD-600).

BUY MORE THAN BEFORE—IN THE 5TH WAR LOAN

DU PONT

DU PONT ELECTROCHEMICALS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

Our Hats Are In The Ring . . *for Victory and "C" Day*

THIS is a year of campaigns—campaigns for Victory on the War Fronts—campaigns to win the Peace on the Home Front—your own campaign for Post-War Business—with vital issues to be decided now, if you are to meet competition, keep your men at work, yes, even stay in business.

In the Campaign for Victory, "D" Day will ever be remembered. With Victory won, will come still another day no less important to the Campaign for Peace—"C" Day—the day of conversion to peacetime manufacture. This is the day that will keynote the struggle of every American business as it makes its bid for existence in the post-war world. Already many materials are becoming less critical. It's time you looked over the qualifications of likely materials for your post-war products. Many will compete for your vote—glass, plastics, wood, aluminum, new alloys, new steels. The choice won't be easy — for the one you elect must provide your product with the most in durability, efficiency and appearance.

If an improved finish can increase the durability, efficiency and appearance value of your product—then McAleer resourcefulness can be of service to you. For many years McAleer service has been characterized by a probing, restless impatience with ordinary finishing materials and methods. Since America's entrance into the war, our efforts to serve industry have led to developments in wartime finishes so far superior to those produced for prewar products, the contrast is truly amazing.

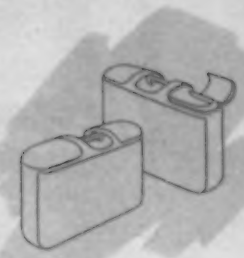
McAleer's war record of achievement in producing *quality-controlled* finishing materials with an almost unbelievable versatility of applications can only be excelled by the results we are prepared to produce when new and strategic materials are made available for your post-war product use.

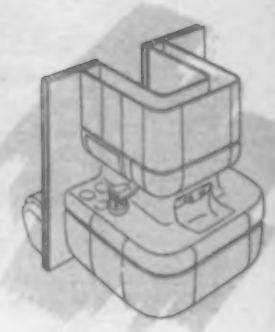
No manufacturer concerned about the present or future can afford to overlook the extra values that an improved finish can give his war or post-war product. *OUR HATS ARE IN THE RING . . . for Victory and "C" Day.* We'd like to present the qualifications of our candidates to meet your particular war and post-war finishing requirements.

McAleer MANUFACTURING CO.

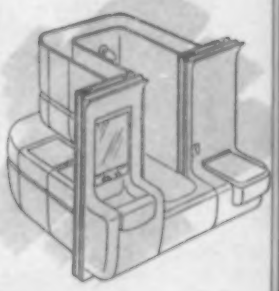
Manufacturers of Quality Controlled Finishing Materials

ROCHESTER, MICHIGAN





When you plan
Your
After-the-War Product



VIRGINIA-LINCOLN CORP.
MARION, VIRGINIA

. . . consider **Valinite**

Victory is our business now. Send your dollars up to the front lines in War Bond uniforms. They'll put weapons into our fighters' hands; boost their morale. After Victory, your War Bond dollars will buy $4 worth for the $3 you give up now. Dig deeper!

New horizons loom for products made of Valinite — the new low-pressure reinforced plastic. Steel-like strength, with cork-like weight . . . brilliant colors that go all the way through . . . astonishing impact strength . . . formed to shape, tiny or huge. Valinite may impart revolutionary new features to your product.

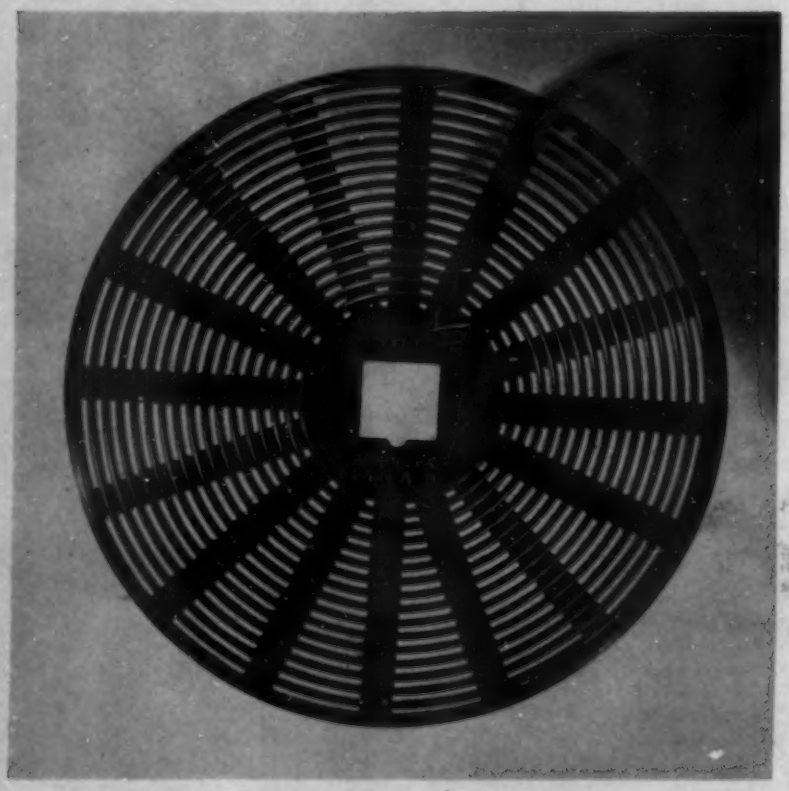
Yes — we can reproduce the truck bodies shown above — carrying gasoline, or milk, or hard-to-handle chemicals. To the fleet owner — individual styling of bodies — distinctive streamlining and curvatures — without the prohibitive cost of steel dies and tooling. Let us prove it!

The Real Sensation in Plastics

K.E.M.

MAKALOT K.E.M.—developed to replace critical Phenolics—gives the molder just what he needs at this time. This less-critical material effects tremendous savings in Phenol & Formaldehyde for more critical War uses. K.E.M. LOOKS like Phenolics, MOLDS like Phenolics, has similar properties and generally will give comparable results.

The versatility of K.E.M. is again demonstrated by THE TAYLOR MFG. CO. of Milwaukee, Wis., in the Valve Float Ball shown on the right. TAYLOR MFG. CO., one of the most progressive and successful molders of Plastics, may justly be Proud of their success in adapting Makalot less-critical K.E.M. for this essential civilian purpose.



MAKALOT PHENOLIC PLASTICS

for Dependability

The Tech-Art Plastics Corp. of Long Island City, New York, well-known for their skill in both design and molding of intricate Plastic Products, selected our Phenolic Impact material #1804 for the Aeroflex reel featured on the left. Note the free flowing, the accurate dimensional tolerances and the fine finish. MAKALOT NEVER FAILS THE USER. Other outstanding MAKALOT PHENOLICS are:

Makalot #93-C—CFI-10; Fabric filled super-impact.

Makalot #1040—MFE. The #1 Low Loss material with superior molding characteristics.

Makalot #1163—CFG. General Purpose—unsurpassed in molding and final quality.

Makalot #1912—Exceptionally long flow for transfer molding.

Makalot #1941—Non-bleeding closure material. Brilliant finish, fast cure, improved stripping and unscrewing properties.

NEWS!!!

MAKALOT'S ADHESIVE #301

A new idea in thermoplastic Adhesive where a really effective seal against water and alcohol is required. Used under either air or heat drying conditions. Application by brush, dip or spray.

"KEEP 'EM MOLDING"

Makalot

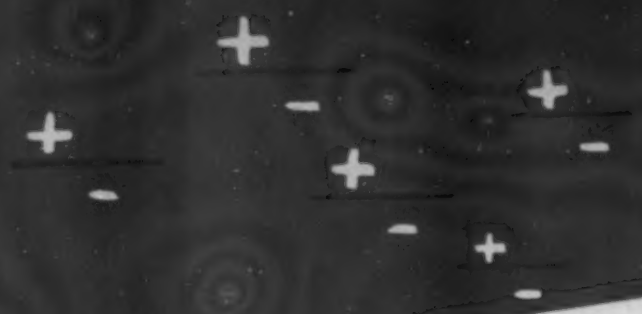
CORPORATION

262 WASHINGTON ST., BOSTON, MASS.

Central States Representative: C. R. Olson, 1020 15th St., Rockford, Ill.

Pacific Coast Representative: Milton Turk; 1425 S. Flower St., Los Angeles, Calif.

The Independent Producer of Superior Plastics



MANUFACTURERS OF PRECISION-MADE PULP AND PAPERS FOR MORE THAN FORTY YEARS • MUNISING PAPER

PRECISION-MADE PULP AND PAPERS FOR THE PLASTICS INDUSTRY:

SUBJECT: STATEMENT OF POLICY

The Munising Paper Company manufactures paper for the plastics industry to meet individual specifications and specific needs. We do not impregnate or convert papers, as we believe our function in the industry is that of a basic supplier.

Through careful, meticulous control we have developed a precision type of manufacture in both the pulp and paper mills so as to make paper uniform throughout the run and in successive runs. By uniformity we mean uniform absorbency, density, caliper, and formation.

Consequently, we are interested in the difficult, the particular, the specialized need, where close tolerances are important, rather than grades where uniformity of delivery is of little value.

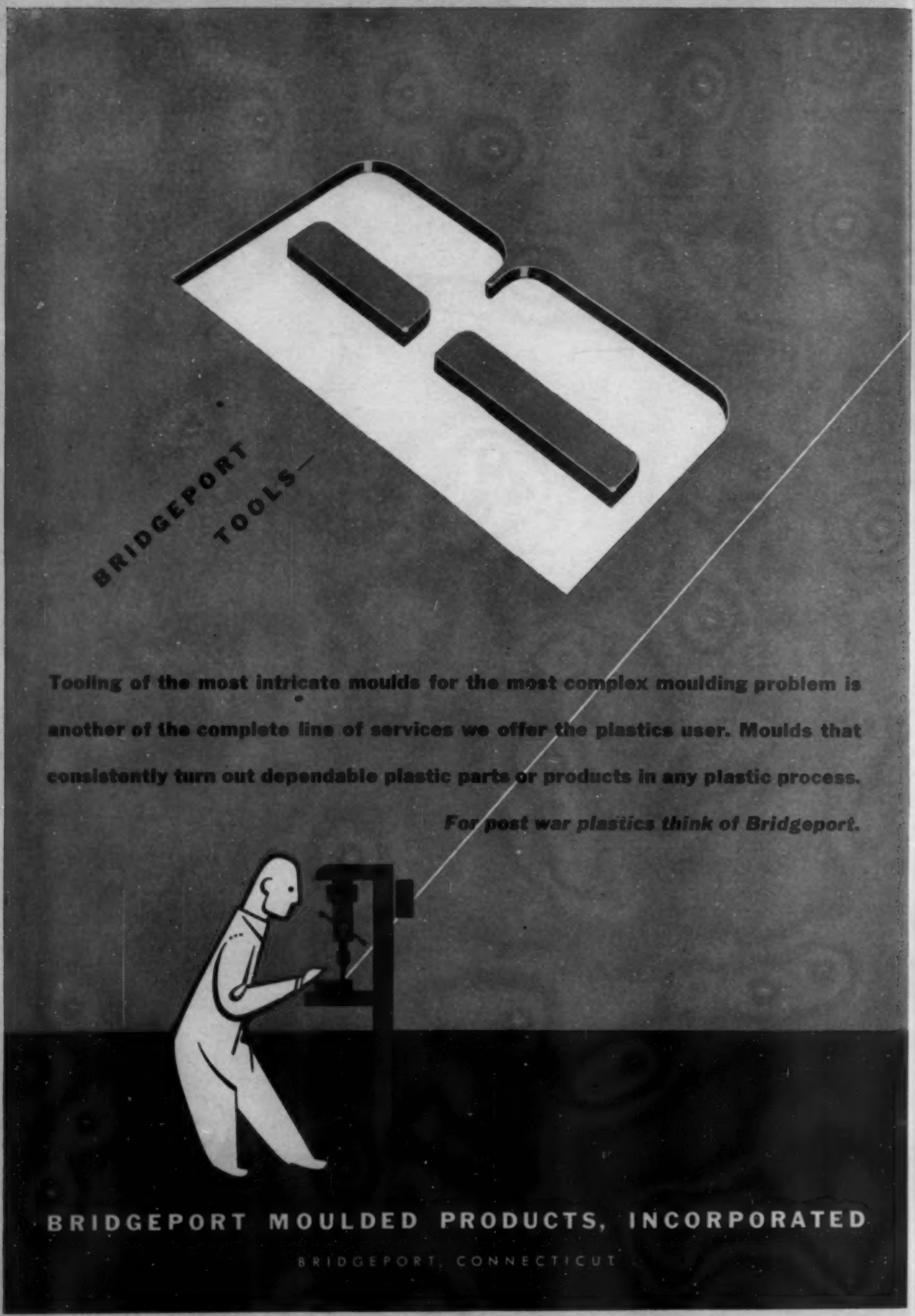
The papers we manufacture for the plastics industry range from the closed, dense, coating stocks for solvent and hot melt coats, through tube stocks, to highly absorbent 3 to 10-mil thermoplastic resin impregnating papers. The highly absorbent grades handle well with either aqueous or nonaqueous solvents.

The Munising Paper Company suggests that possibly the potentialities of paper with its tremendous range in properties are largely unrealized. There are probably as many variations in the properties of different papers as there are in the properties tions of resins. Is it possible that the available variations in caliper, porosity, fiber length, or pH might contribute to the effectiveness of your product if your papers were made and designed specifically for your needs?

THE MUNISING PAPER COMPANY

Sales and Executive Offices
135 S. LaSalle St., Chicago 3, Illinois
Pulp and Paper Mills
Munising, Michigan

THE MUNISING PAPER COMPANY



Tooling of the most intricate moulds for the most complex moulding problem is another of the complete line of services we offer the plastics user. Moulds that consistently turn out dependable plastic parts or products in any plastic process.

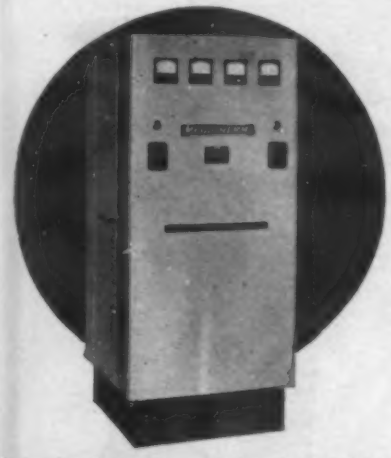
For post war plastics think of Bridgeport.

BRIDGEPORT MOULDED PRODUCTS, INCORPORATED

BRIDGEPORT, CONNECTICUT

The 4" diameter preform shown was made in a 75 ton press and heated to full molding temperature in 30 seconds with the popular 3 KW Megatherm.

WITH
-MEGATHERM-
DIELECTRIC HEAT



Federal Industrial Power Tubes, built with the ultimate of care and workmanship, give power and performance to Megatherm and other industrial heating equipment.

Right at the point of your pencil is proof that Federal's Megatherm produces absolutely *uniform* preheating . . . a slight pressure and the pencil pushes right through the preform!

Megatherm's High Frequency Heat achieves this homogeneous plastic state in *seconds!* And that's not all . . .

As a result *mold pressures are drastically reduced*—since the uniformly heated material flows more easily. This means less stress on die inserts and no internal stress in the form when curing cycle is completed. Thus you can do precision molding, free of porosity, with lighter equipment. And you can reduce curing time from minutes to seconds, double or triple production, and eliminate warping and cracking — even on compression molding of thick sections!

Megatherm arrives at your plant ready to go to work and requires no skill to operate, no change in plant layout.

Get the full story today from Federal—the world famous name that is synonymous with industrial electronic progress.

Federal Telephone and Radio Corporation

INDUSTRIAL ELECTRONICS DIVISION — An IT&T Associate — Newark 1, N. J.

SOUTH BEND LATHES

FOR CLOSE TOLERANCES AND SMOOTH FINISH

To meet war production demands, close tolerances and smooth finishes must be maintained without sacrificing output. Machine tools must have the accuracy, speed, and rigidity required for the efficient machining of exacting work.

These are the kinds of jobs for which South Bend Lathes are designed. The smooth operation, wide range of spindle speeds, power, dependable accuracy, and rigid construction of these lathes enable them to hold the tolerances and produce the finish that is required.

South Bend Lathes are made in both Toolroom and Engine Lathe types with 9″, 10″, 13″, 14½″, and 16″ swings, which cover a wide range of work. Also precision turret lathes. Write for a copy of Catalog 100-C in which they are all described.

SOUTH BEND LATHE WORKS

Lathe Builders for 37 Years — **South Bend 22, Indiana**

Specifications

Swing over bed . . 10½″
Spindle bore . . . . 1⅛″
Maximum collet capacity . 1″
Thread cutting feeds (48)
. . . 4 to 224 per in.
Spindle speeds (12)
. . 50 to 1357 r.p.m.
Power longitudinal and
cross feeds . . . 48

★

BUY WAR BONDS

★

10″ SOUTH BEND LATHE

"HOW TO RUN A LATHE"

A helpful handbook on operation and care of engine lathes. Contains 128 pages, 5¼″ x 8″. Price 25c.

What makes a plastic molder?

Machinery? Certainly equipment is mighty important, and that's why General Industries Company has one of the finest equipped plants in the country—including presses for every type of molding, from very small to extremely large sizes.

Mold making? You can't expect to get a perfect molded part unless the pattern is perfect. That's why we prefer to make our own molds. In all modesty, we believe the ability of our mold designers and makers can't be excelled by any plant in the nation. The right molds mean accuracy, fine finish with a minimum amount of time and cost for machining or hand work.

Materials? Every molder has access to the same materials, but all do not have the knowledge required to select exactly the right material for the finished job, and to work it in the most efficient and economical manner. That's where experience counts, and we do have that experience.

Resourcefulness? Every plastic molding job we undertake is studied carefully by our engineers to see if any way can be found to improve the quality and utility of the part and reduce the cost. Frequently, from our experience we are able to accomplish all three of these objectives.

Reliability? This perhaps is the most important characteristic of all. It means deliveries on time, of the quality specified, at the price quoted, without bickering. Many customers tell us they prefer General Industries because they know we won't let them down in even the smallest particular.

So, if you are planning postwar products which include molded plastics, we suggest you keep in touch with us. Right now, we're so full of Uncle Sam's work that we cannot take on anything additional. But when that job is finished, we'll be glad to work with you.

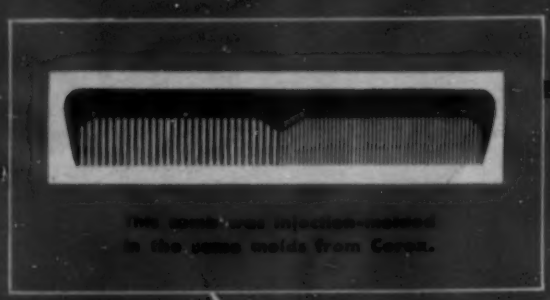
THE GENERAL INDUSTRIES COMPANY
ELYRIA • • OHIO

THE GENERAL INDUSTRIES COMPANY
MOLDED PLASTICS

Molded Plastics Division • Elyria, Ohio

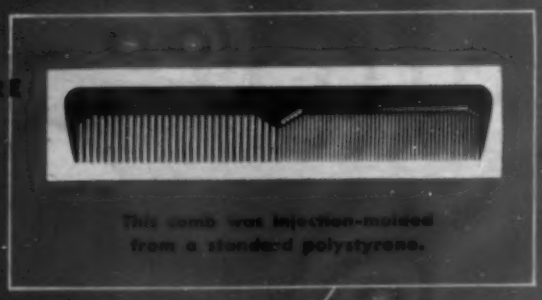
Chicago: Phone Central 8431
Detroit: Phone Madison 2146
Milwaukee: Phone Daly 6818
Philadelphia: Phone Camden 2215

CEREX



This comb was injection-molded in the same molds from Cerex.

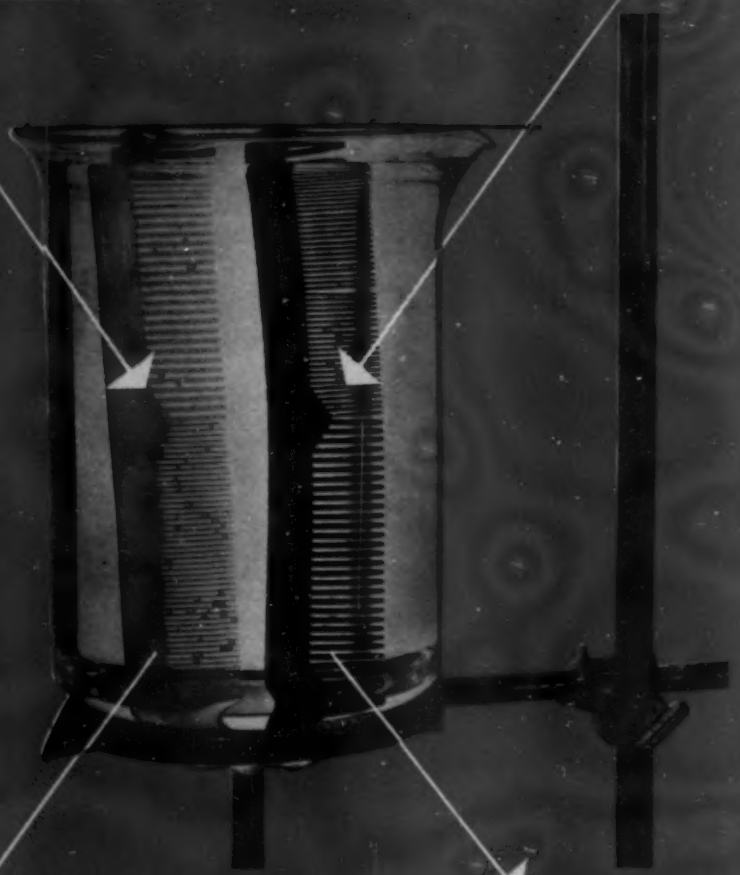
BEFORE

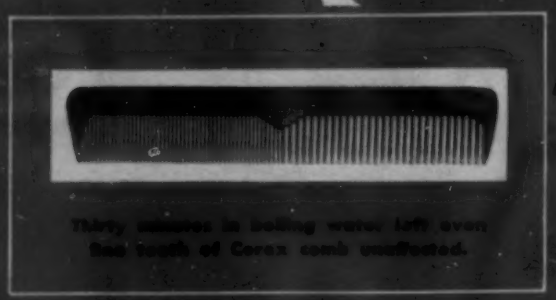


This comb was injection-molded from a standard polystyrene.

IMPORTANT—HEAT RESISTANCE UNDER LOAD

These combs are graphic proof of the fact that parts molded of Cerex to close dimensional tolerances maintain their dimensions even during prolonged exposure to boiling water. The standard ASTM test, however, is even more severe than this demonstration since it calls for application of a load on the test specimen. This is obviously important since most molded parts are subjected to some external stress in actual service and to residual molding strains. ASTM heat distortion points of Cerex formulations thus determined under load range from 220° to 230° F.





Thirty minutes in boiling water left even fine tooth of Cerex comb unaffected.

AFTER

Ten minutes in boiling water (212° F.) did this to the polystyrene comb.

A NEW THERMOPLASTIC SERVICEABLE IN BOILING WATER

Monsanto Research Makes Plastics News of the Year With First Injection Molding Material Ever Developed That Can Hold Shape Under Stress at Temperatures Above 212° F!

FROM MONSANTO research laboratories comes news of one of the most significant advances in the history of modern plastics . . . *a new plastic that can be used at temperatures well above the boiling point of water . . . yet can be fabricated with the mass-production speed and economy of injection molding!*

The new material, which opens up entirely new fields of usefulness to plastics, is *Cerex—a thermoplastic that combines record-breaking heat resistance with excellent electrical insulating properties, high rigidity and strength and unusual chemical resistance.*

HEAT RESISTANCE

Until development of Cerex, the highest heat distortion point reported for any thermoplastic was 214°F. and virtually all compounds with values over 200°F. were special formulations not suitable for general use. In fact, to all practical purposes, injection molding has been possible only for applications where temperatures of less than 160° to 170°F. were encountered.

ASTM heat distortion points of Cerex, however, range from 220° to 230° F. for the formulations showing greatest promise . . . and this unprecedented heat resistance is attained without any sacrifice in moldability so that Cerex can be molded on standard injection machines at temperatures slightly lower than polystyrene in molds designed for other thermoplastics.

OTHER CEREX PROPERTIES

Other outstanding Cerex properties include excellent indentation hardness, with Rockwell hardness values well above any other moldable thermoplastic . . . good electrical properties . . . good strength properties, with tensile values in the same range as Lustron and somewhat higher flexural strength . . . good color possibilities since Cerex is naturally a clear, transparent amber and is compatible with a rainbow-wide range of dyes and pigments.

Chemical resistance of Cerex is unusually good. It is not affected by alcohols, alkali or strong, non-oxidizing acids. In a series of prolonged tests, parts molded of Cerex withstood conditions that corroded enameled steel and attacked the surface of aluminum, while battery cases of Cerex have been subjected to boiling sulfuric acid solutions without effect.

HOW TO USE CEREX

Cerex compounds will be priced within the present range of injection molding materials. While they undoubtedly will prove more desirable for some applications already filled by other plastics, *their chief value will be in jobs for which no present-day plastic is fully qualified, physically or on a finished cost basis.*

A few of those jobs are listed in the box to the right but many more possibilities will occur to molders or designers for making good use of Cerex's unique combination of properties.

HOW TO GET CEREX

Cerex is still in pilot plant production and only limited quantities will be available for direct military uses until large-scale facilities can be built.

Sample quantities, however, can now be supplied and arrangements made for experimental molding of test samples on critical war applications where no other available plastic is satisfactory.

If you have an application for Cerex that meets those qualifications, write or wire for full details: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

Immediate Possibilities

Surgical and dental instruments that can be sterilized in boiling water.

Battery cases that would be unaffected even by boiling sulfuric acid solution.

Many electronic instrument parts now molded from mica-filled phenolics.

Many essential industrial applications requiring high heat and chemical resistance.

Postwar Possibilities

Colorful, tough tableware, that could hold boiling water.

Bright, attractive kitchen utensils that could be safely washed in boiling water.

Plumbing hardware that could add a new note of color to bath and kitchen.

Special types of packages requiring high resistance to heat or chemicals.

For first time, small radio cabinets could be successfully injection molded.

The broad and versatile family of Monsanto Plastics includes: Lustron polystyrenes • Monsanto vinyl acetals • Nitron cellulose nitrates Fibestos cellulose acetates • Resinox phenolic compounds • Resimene melamine compounds. Forms in which they are supplied include: Sheets • Rods • Tubes • Molding Compounds • Industrial Resins • Coating Compounds • Vuepak Rigid, Transparent Packaging Materials.

MONSANTO PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

READY TO DROP BACK OF THE ENEMY'S LINES
AMERICAN PARATROOPERS AWAIT THE SIGNAL

What we do is **NOTHING** *compared with what they do*

Our Waterbury Button Company Division has made most of the uniform buttons for the Army, Navy and Marines for the last Six Wars—1812, 1846, 1861, 1898, 1917, 1941. All six Divisions of Waterbury Companies are working practically 100% on essential war products.

PLASTIC MOLDING
PLASTIC LIGHTING FIXTURES
METAL SUNDRIES
EYELETS
UNIFORM & DRESS BUTTONS
Our Engineers and Designers will work with you

WC INC 1812

SPI SOCIETY OF THE PLASTICS INDUSTRY

WATERBURY COMPANIES, INC.

Formerly Waterbury Button Co., Est., 1812

DEPT. B, WATERBURY, CONNECTICUT

WHAT'S YOUR PROBLEM?

KEYES ESTABLISHES NEW SERVICE DEPARTMENT TO HELP YOU

IF... you haven't yet found time to run down the plastic best suited to that new part or product . . . **IF** . . . you are "making do" when you could have maximum efficiency with better equipment . . . **IF** . . . production is being held up because you can't get priorities on metals, whose purpose could be duplicated by a strong light weight plastic . . .

. . . THEN our new Service Department can help you! Bring your problems to Keyes . . . at your service for consultation. Write us, or tell our salesmen, your specifications and requirements. Our staff of engineers can tell you quickly whether or not Keyes Fibre can produce the item in KYS-ITE. Furthermore, if the article you need cannot be made of KYS-ITE, we will be glad to suggest the companies that can do the job for you.

THESE ARE THE UNIQUE PROPERTIES OF *KYS-ITE*

THE LONG-FIBRED WOOD PULP-FILLED PHENOLIC RESIN PLASTIC, PREFORMED BEFORE CURING.

1 Preforming before curing results in even distribution of fibres . . . insures dimensional stability . . . gives KYS-ITE 4 to 5 times the impact strength of ordinary plastics. Replaces metal parts where great strength and light weight are necessary.

2 Adaptable . . . can be molded into simple or intricate forms, ranging from bowls to typewriter bodies. Can be molded to close tolerance for fitting with metal or other material parts. Can be machined, drilled, decorated.

3 Unusually durable and resistant to abrasion. Impervious to mild alkali and acid solutions.

4 Non-conductor of electricity. Poor conductor of heat and cold. Not affected by temperature changes and extremes.

5 KYS-ITE is custom-molded to your exact specifications. Units are delivered complete.

• • •

We are now scheduling future production as orders are placed. May we suggest you contact us promptly? And remember, we are constantly at your service to help you solve present or post-war production problems.

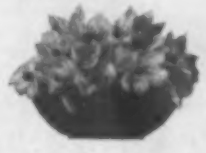
Buy War Bonds—More Than Before

PISTOL GRIP

ADDING MACHINE HOUSING

ROLLER

VALVE WHEEL

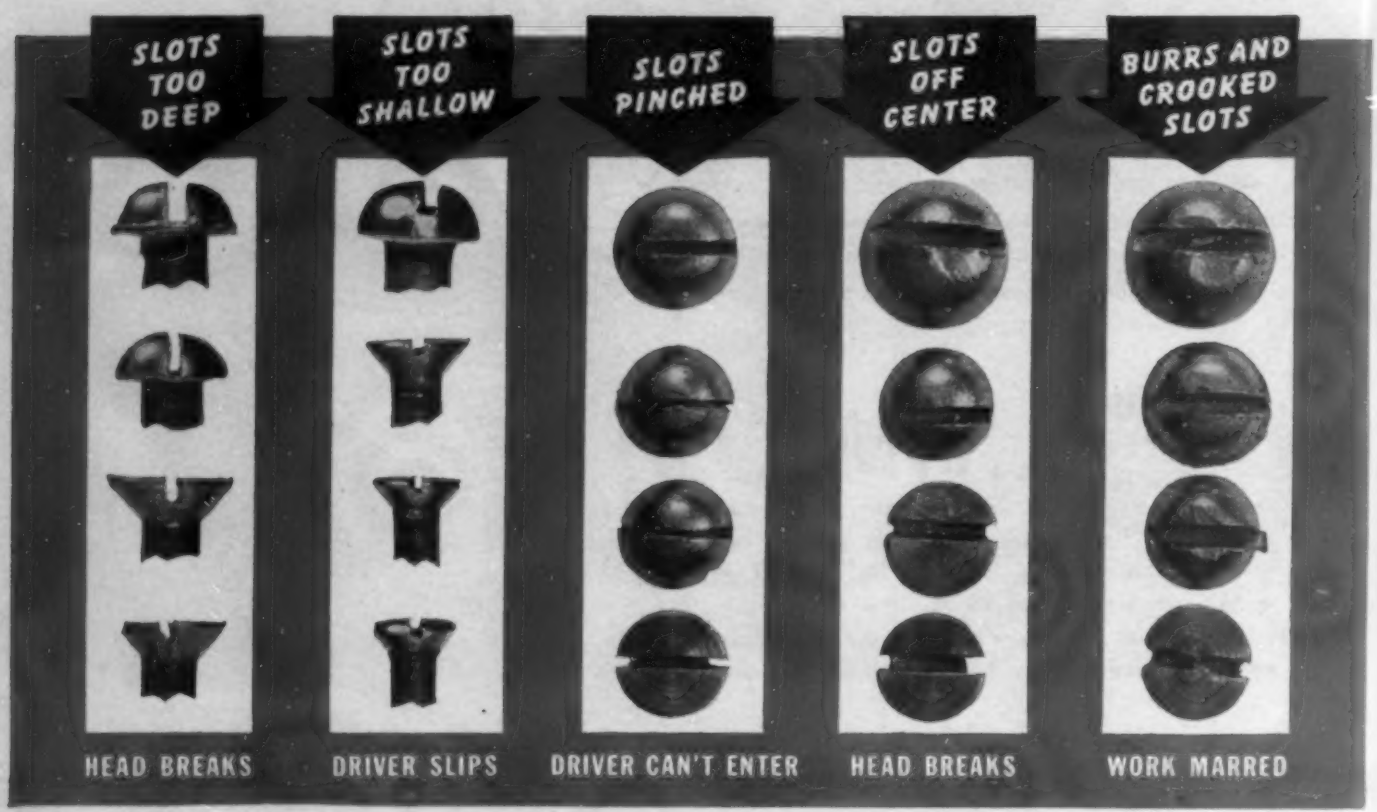


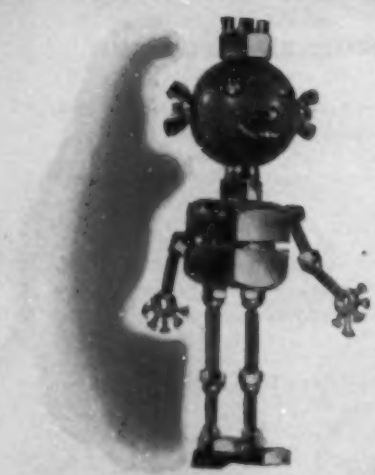
BOWL

KEYES
MOLDED PRODUCTS

KEYES FIBRE COMPANY • 420 Lexington Avenue, New York 17, New York • Plant at Waterville, Maine

There's a big difference in Fasteners...even in ordinary Slotted Screws. It pays to insist on Fasteners that are made right. Here are some common faults to look for in Slotted Screws...





National
HEADED AND THREADED
PRODUCTS

It is commonly assumed that "screws are just screws"—all pretty much alike—regardless of who makes them. However, quality varies widely even in the common wood or machine screw, and it makes a lot of difference both in assembly time and in amount of spoiled or marred work.

The enlarged photographs above picture a number of the common faults actually found in a single purchase of commercial screws NOT made by *National*.

Insist on the screws you buy having clean slots of the right depth, properly centered, free from burrs, with good threads and points. Attention to details such as these will result in lower assembly costs and a much better product.

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

MODERN PLASTICS
JULY 1944 VOLUME 21 NUMBER 11

Maximum price regulation order

by S. S. ULLMAN*

ON March 27, 1944, the Office of Price Administration put into effect Maximum Price Regulation 523, and by that step gave recognition to that group of manufacturers known generally as the "Plastics Industry." This regulation is an industry regulation. No longer does a product's end use determine which of three or four regulations is applicable or whether it is entirely exempt from price control. No longer are a number of diverse pricing methods applicable to the manufacturers of plastics products. All such products, even those used solely for military purposes, are now covered by this one regulation and are priced in accordance with the same method. Therefore, if you are a molder, a fabricator, an extruder or process plastics materials by any other means, MPR 523 establishes your maximum prices. Please note we do not say "selling" prices. This regulation establishes a price ceiling. Sales above this ceiling are violations. Sales below this may be due to competitive conditions or may be just good business policy.

How are these maximum prices established? Here is an industry which does not produce items which readily lend themselves to price lists and catalogs. The greater proportion of its production is based upon customers' blueprints and specifications. And so all plastics products were divided into two general classifications: 1) those that were sold or offered for sale during the period from Jan. 1 to March 31, 1942, and 2) those that were not sold or offered for sale during that period.

The maximum prices of items in Group 1 may be said to have been "frozen." Where there was a published list price in effect on March 31, 1942, that price became the maximum price, less, of course, discounts and allowances. For a non-list price item, the last price at which it was sold or offered for sale during that three-month period became its maximum price, adjusted to reflect discounts and allowances, and the customary differentials between various classes of purchasers.

As an illustration, let us assume that the Oldtyme Plastics Corp. molded a line of compacts in addition to operating as a custom molder. Its catalog or published price list dated Feb. 15, 1942, scheduled 10 different styles of compacts which it offered to jobbers at $24 per dozen, less a discount of 40 percent. It offered these same styles to department stores at $24 per dozen, less a discount of 25 percent. Under the provisions of MPR 523, the Oldtyme Plastics Corp. today must sell these same compacts at no more than $24 per dozen, less a discount of 40 percent to its jobbing trade, and less a discount of 25 percent to its department-store customers.

Pursuing this illustration further, the Oldtyme Plastics Corp. on Jan. 10, 1942, quoted a price of $50 per thousand for part No. 10 to one of its customers, and received the order. On Feb. 15, 1942, it quoted $65 per thousand for the same part and again received the order. On March 20, 1942, having developed a more economical production method, it quoted $60 per thousand for the same part, but this time did not obtain the order. For its current maximum price for part No. 10, our molder may quote no more than $60 per thousand, since that was the last price at which it was offered for sale during the first quarter of 1942.

This brings us to the items in Group 2, those which were not sold or offered for sale during the base period. The maximum prices of such products are established by what is known as "formula pricing." For this classification, the price-determining method in use in the molder's or fabricator's plant on March 31, 1942, has been "frozen." The term "price-determining method" means nothing more than the cost-estimating formula or method in use in any manufacturing establishment for the purpose of setting selling prices. MPR 523 requires that in such method the costs of raw materials be included at March 31, 1942, costs or at current costs, whichever are lower. Labor rates must be computed at March 31, 1942, rates for similar skills or classifications of labor. Factory overhead, general administrative and selling expenses, profit margin and any other bases of computation in use in his plant for plastics products—all these must be currently included at rates no higher than those in effect in his plant on the base date, March 31, 1942. A report of such pricing methods and the rates applied must be filed with Office of Price Administration, Washington, D. C.

Recognizing the fact that most initial selling prices are based upon an estimate and that the actual production experience may be vastly different, the regulation permits one recomputation should the purchaser re-order a particular item. Recomputation simply means a review of the costs of the actual production run. This review must apply the approved base date pricing formula. Should the recomputation result in a higher price, and should the manufacturer choose to charge this higher price, he must file a report with Washington, answering four simple questions. Should the recomputation result in a lower price, this lower price becomes the new maximum price, but no report need be filed. Similarly, no report is necessary should the recomputation result in the same price. Having recomputed on the basis of an actual production run, the maximum price has thereby been established and is not subject to further recomputation.

Let us assume that our molder, the Oldtyme Plastics Corp., on June 15, 1943, accepted an order for part No. 101 at $100 per thousand. His price was (*Please turn to page 172*)

* Senior Business Analyst, Machinery Branch, Office of Price Administration.

High-, low- and no-pressure laminates

by CARROL C. SACHS*

CONSIDERABLE confusion seems to exist as to just what types of laminates are available to the designer and fabricator, their methods of fabrication, and the economic and design limitations of each. High-pressure laminating is well established with many years of application in electrical and decorative fields behind it. In contrast, low-pressure and no-pressure laminating are such recent industrial developments that both might be accurately called "war babies." Therefore, since both the techniques and materials used in low- and no-pressure laminating are still in the formative stage, the following comparisons will, necessarily, be subject to considerable revision over the next few years.

History and development

The development of high-pressure laminating has been parallel to that of the electrical industry with its demands for sheet stocks, possessing dielectric strength comparable to sheet mica, which could be punched and cut into various shapes. In the years following the establishment of the industry, the various grades of laminates were gradually standardized under various N.E.M.A. codes and specifications with mechanical and decorative stocks carrying the connotation of "specialties." The bulk of the high-pressure laminates has always been in the form of flat sheet stock and, in all probability, sheet stock will continue to be the backbone of the industry. High-pressure laminates are generally considered as being produced under pressures of 1000 to 3000 p.s.i., with pressures as low as 700 p.s.i. occasionally used where special treating equipment is available. Both the presses and the impregnating machines are standardized. Because of the heavy capital investment required in the field, few changes have been made either in the treating or pressing equipment since the industry was founded. One engineer in the field stated recently that new and improved impregnating machines already under design would double the flexibility of the industry from the standpoint of both control and production. The characteristics of high-pressure laminating are listed in Table I as are those for low- and no-pressure laminating.

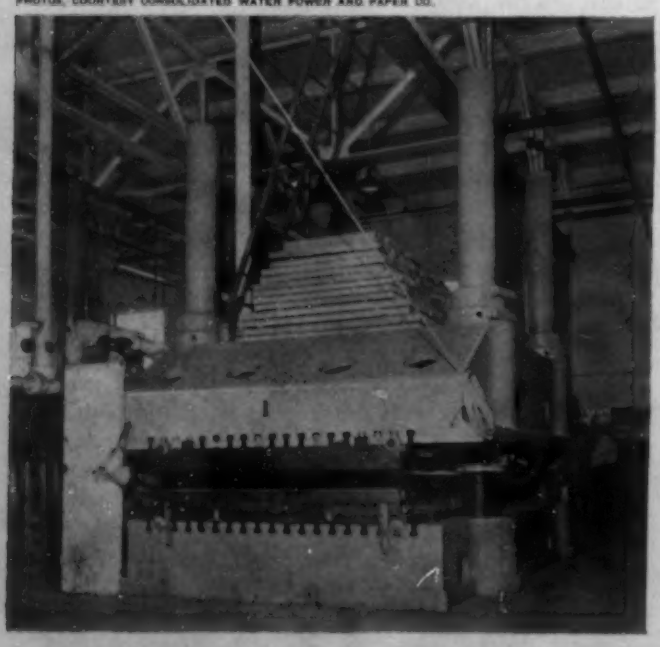
In 1940 low-pressure laminating was but an idea—a request to one of the large materials manufacturers to see what could be done to meet the problems involved in the application of laminates to the fabrication of military airplanes. Surveys showed that if laminates were to be used in airplanes, the pieces required for the application would be of such large area as to make high-pressure laminates impractical in view of the tremendous tonnage required from the presses. Because of relatively small production requirements, amortization of such large presses and laminating molds was impossible. The need of a laminating process which would be applicable to large formed sections molded under low unit pressure was apparent. The metal forming hydro-presses already available in the various aircraft plants were analyzed and found capable of delivering a pressure of approximately 4000 p.s.i. over the entire bed area which measures approximately 6 by 15 feet.

To provide some safety factor it was decided to concentrate on the development of laminating varnishes which would plasticize and cure satisfactorily at 250 p.s.i. As a result of the excellent cooperation of the resin manufacturers with the aircraft industry, suitable resins were soon developed. In the following years, improved low-pressure varnishes were produced which were capable of being laminated at pressures as low as 40 p.s.i. Low-pressure laminating is generally considered as occurring at pressures of from 40 to 300 p.s.i. The reduction in pressure is partially accomplished by treating to a relatively high volatile content—5 to 7 percent.[1] This is not a necessary condition, however, since the resin itself

* Research engineer, Lockheed Aircraft Corp

[1] Volatile content is the percentage of residual solvent after impregnation and drying of the filler stock (paper, fabric, etc.).

PHOTOS, COURTESY CONSOLIDATED WATER POWER AND PAPER CO.

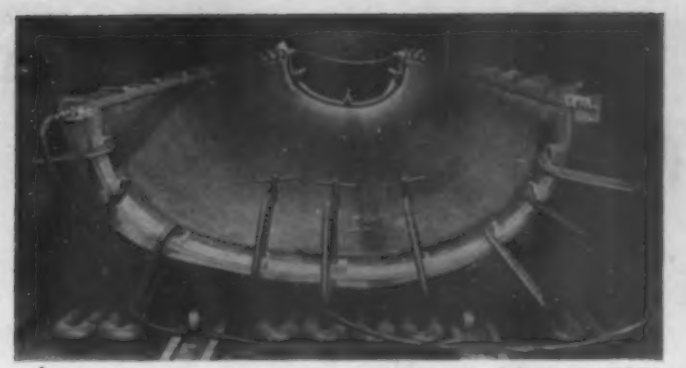


1

2

1—This huge press which is used in the production of high-pressure laminated panels can accommodate 72 by 192 in. sheets. 2—High-pressure laminated panels such as these are used for the flooring of giant C-87 express planes

PHOTO, COURTESY VIRGINIA LINCOLN CORP. 3



4 PHOTO, COURTESY U. S. ARMY AIR FORCES, WRIGHT FIELD

3—An experimental assault boat molded from glass fabric and low-pressure resins. Postwar plans contemplate the production molding of the boats in 3 sections—universal bow, stern and center. Thus, the over-all length of the boats will depend upon the number of center sections employed. 4—Low-pressure resin with high-strength glass-fiber filler was used in the molding of this half section of an experimental BT-15 airplane fuselage

may be precured so as to laminate at low pressure at volatile contents as low as $^1/_2$ percent.

The development of no-pressure laminates was the result of attempts to produce polyester resins suitable for casting into transparent sheets. Naturally, cast-type laminates appealed to the aircraft engineer as more than filling the pressure requirements desired. Actually, however, no-pressure laminates is merely a phonetic term (high, low, no) to identify the group, since the laminates are usually subjected to at least atmospheric pressure—15 p.s.i.

No-pressure laminates have been called "contact" pressure laminates, a term requiring clarification. Flat sheets may actually be produced under contact pressure—atmospheric pressure plus the weight of the caul—but practice has dictated that formed sections invariably require pressures of 25 to 70 p.s.i. to prevent resin segregation and the formation of lakes as well as to control the final resin content within engineering tolerances. Reference to Table I will indicate that no-pressure laminates are formed in the pressure range from "contact pressure" to 70 p.s.i.

Equipment

Standard high-pressure hydraulic presses are used throughout the high-pressure laminating industry. Because of the small deflections permitted in the press construction, this type of equipment is very expensive and hence is limited to heavy industrial set-ups capable of sustaining the large investment. The presses are generally of the muli-platen type suitable for the production of flat sheets.

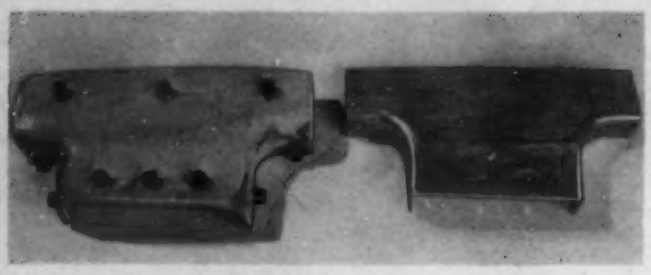
Low-pressure laminating is performed on presses having considerable daylight. The latter requirement is due to the fact that the process is generally applied to formed shapes rather than thin flat sheets. Formed shapes demand proportionately thick molds. Therefore, sufficient press opening (or daylight) to accommodate the various molds is required especially during the loading and ejecting operations. Since

TABLE I.—MOLDED LAMINATING

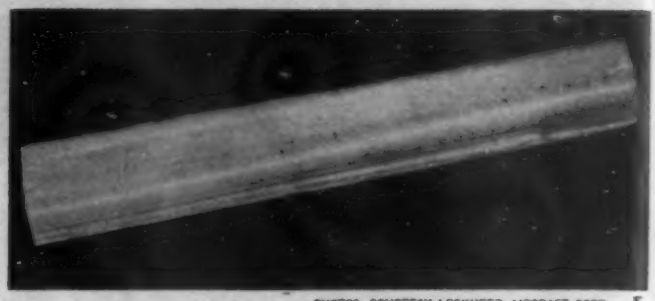
	High pressure	*Low pressure*	*No pressure*
Pressure range	1,000 to 3,000 p.s.i.	40 to 300 p.s.i.	Contact to 70 p.s.i.
Production	High production	Moderate production	Very limited production
Generic resin type	Thermosetting	Thermosetting	Thermohardening
Method of polymerization	Condensation	Condensation	Addition
Reaction equation	$N(XY) \xrightarrow[\text{cat.}]{\Delta} (XY)_N - H_2O\uparrow$	$N(XY) \xrightarrow[\text{cat.}]{\Delta} (XY)_N - H_2O\uparrow$	$N(AXB) \xrightarrow[\text{cat.}]{\Delta} (AXB)_N\uparrow$
Polymolecular structure	Crosslinked	Crosslinked	Crosslinked
Character after cure	Insoluble and infusible	Insoluble and infusible	Insoluble and infusible
Form	Resin in solvent	Resin in solvent	100% resin monomer
Relative cost	20 to 30 cents per lb.	25 to 35 cents per lb.	60 cents to $2 per lb.
State of cure when impregnated	"B" Stage resin	"B" Stage resin	Monomer or partially bodied polymer
Consistency	Dry	Dry	Syrupy
Stability of the impregnated stock	Stores satisfactorily 3 to 6 mos. in cool place	Stores satisfactorily 3 to 6 mos. in cool place	1 to 10 days in absence of air after catalyst is added
Cure temperature	315° F.	315° F.	Cycle cure 100° F. →→→ 240° F.
Cure time	3 to 5 mins.[a]	3 to 5 mins.[a]	30 mins. to 8 hrs.
Type of mold	Steel	Cast iron, Kirksite, aluminum	Wood, plaster, concrete, cast phenolic
Type of catalyst	Generally alkaline	Generally alkaline	Benzoyl or lauroyl peroxide
Catalyst stability	Stable	Stable	Poisoned by contact with air
Separators	Zinc or calcium stearate dust	Zinc or calcium stearate dust	Cellophane or polyvinyl alcohol film
Toxicity	None	None	Dermatitis possible with allyl alcohol types

[a] For $^1/_8$-in thickness.

6



7



PHOTOS, COURTESY LOCKHEED AIRCRAFT CORP. 5

5—This combination antenna mast and pitot tube support is mandrel wrapped from glass fiber fabric and no-pressure resin. 6—This is an end view of the combination antenna mast and pitot tube support shown in Fig. 5. The anti-icer duct, at the extreme left of this piece, is blind and terminates about 1/8 of the length of the mast. 7—This drill jig was made by the no-pressure laminating process. The drill bushings were bolted to the master part at right, and the heavy glass fiber fabric filler was tailored and stretched over the bushings

the unit pressures are about one-tenth those used in high-pressure laminating, the construction of the laminating press is considerably simplified and reduced in cost. In some instances these presses have been actuated with compressed air through the use of pressure multipliers. This system lends itself to automatic cycle control through the use of pneumatically actuated valves. The equipment requires only a moderate investment of capital.

Contact laminating is generally performed with pneumatic or steam-inflated neoprene bags which suffice as a source of pressure and possibly of heat. When air is used as the fluid pressure medium, the assembly is generally heated in an electrical conduction oven that is equipped with a conveyer belt.

Materials

High- and low-pressure laminates are based on thermosetting types of resins dispersed in solvents so as to produce an impregnating varnish. These include phenol formaldehyde, urea formaldehyde, melamine formaldehyde, melamine phenol formaldehyde, phenol furfural, etc. All are members of the resin family known as condensates and polymerization proceeds with the separation of some small molecule such as water, hydrogen chloride, ammonia or, in some cases, a salt. The "B" stage resin is essentially thermoplastic as it is impregnated into the filler material, and it cross links upon curing to the "C" stage to form hard, insoluble, infusible polymers.

In contrast, no-pressure laminating resins are of the thermohardening monomer type and no solvent is necessary to accomplish proper impregnation of fabric or paper. Upon the addition of a catalyst such as benzoyl or lauroyl peroxide, the monomer may be partially polymerized to a consistency by refluxing. Some polyesters may be reacted to a gel stage for application. It is significant that the monomer polymerizes directly to the polymer without the formation of condensate or by-product.

Impregnation and handling

The treating of continuous rolls of filler material usually begins in the rough cutting of the high- or low-pressure thermosetting resin with an appropriate solvent. The solvent diluted synthetic resin is then known as an impregnating varnish. As a general practice, the fine control of the resin content is achieved by controlling the temperature of the impregnating bath, thereby directly controlling the viscosity of the varnish and its penetrating or "pick-up" properties.

It can be seen that considerable economic advantage exists, therefore, in favor of the high- and low-pressure laminating practices in the treating of the filler material with the resin. In general, no-pressure laminates are hand dipped into the thermohardening resin bath immediately before the laying up operation. This procedure is inherently difficult because of the sticky syrupy nature of the resin. A not inconsiderable personnel problem is also involved. The polyester no-pressure resins, especially those which are derivatives of allyl alcohol, further result in frequent cases of dermatitis. Hence, special precautions are mandatory, and many persons find it impossible to handle the materials. On the other hand, the "B" stage resin impregnated lamina of the high- or low-pressure types are dry during the laying up operation and only very infrequent cases of dermatitis have been reported. These rare cases were encountered in the manufacture of the materials rather than in the impregnating operation or in the subsequent laying up.

Again, considerable advantage is found in the thermosetting high- and low-pressure resins from the standpoint of storage after the addition of the accelerator or catalyst to the impregnating varnish. Most types of polyester resins are poisoned by contact with the atmosphere for any length of time. In contrast, the thermosetting "B" stage resins may be stored for periods of several months without suffering deleterious effects.

In a practical sense, the poisoning effect caused by contact of the thermohardening no-pressure resins with air is overcome through the use of separators, usually polyvinyl alcohol or cellophane films, which serve both to exclude the air and to prevent adhesion to the die. The use of calcium or zinc stearate dust facilitates the ejection of thermosetting high- or low-pressure laminates from the laminating mold. Failure to use a separator film over a no-pressure laminate of thermohardening resin generally results in an intermediate gel form which will not cure further. *(Please turn to page 172)*

A new series of thermoplastic resins

by C. L. JONES*

THERMOPLASTIC materials, in general, have many recognized advantages—both from the point of view of fabrication and utility. However, one important disadvantage has militated against their expanded use. This drawback is poor dimensional stability at normal service temperatures. Consequently, the field of application for thermoplastics has been considerably broadened by the advent of the Cerex resins which have A.S.T.M. heat distortion points ranging from 195 to 300° F.—values that actually overlap similar figures for many thermosetting molding compounds now in common use.

The fabricator of thermoplastics can make his selection from a variety of forming processes. Injection molding provides a rapid automatic method for the economical production of relatively small parts. Continuous lengths of rod, sheet, filament and profiles may be extruded. Self-supporting films and sheets may be cast from solvent solution or skived from blocks. These sheets, in turn, may be formed to three-dimensional shapes by drawing, blowing, swaging, spinning or lapping. The materials may be easily joined by heat or solvent cementing.

From the utility standpoint, thermoplastics generically offer excellent color and toughness while individual members present specific advantages such as superb clarity, flexibility and desirable electrical properties. However, because of poor dimensional stability, the product designer frequently has been unable to take advantage of the other desirable properties of thermoplastics and been limited in choice to thermosetting plastics, metals, ceramics or other structural materials—often at the sacrifice of appearance, electrical properties or other desirable characteristics.

An analysis of the causes of the poor dimensional stability of thermoplastics indicates that there are three principal factors: 1) loss of a volatile component such as plasticizer, 2) water absorption and 3) thermal-softening. So that they may be formed at a temperature sufficiently below the decomposition point, certain thermoplastics must be softened by the addition of a low-viscosity ingredient. These agents, or plasticizers, are selected for their good compatibility, low volatility and desirable effect on physical properties. Although they are relatively non-volatile, these additives tend to evaporate and migrate from the plastic. As a plasticizer often represents a substantial proportion of the volume of the plastic, its loss will decrease the volume of the molded part and shrinkage will occur.

The detrimental effect of water absorption is threefold. The absorption of water increases the volume of the plastic with a resultant increase in dimensions and, in certain instances, a subsequent loss of absorbed water actually leaches out soluble components of the mass. Furthermore, water is an excellent plasticizer for most plastics and, accordingly, decreases their form stability at elevated temperatures.

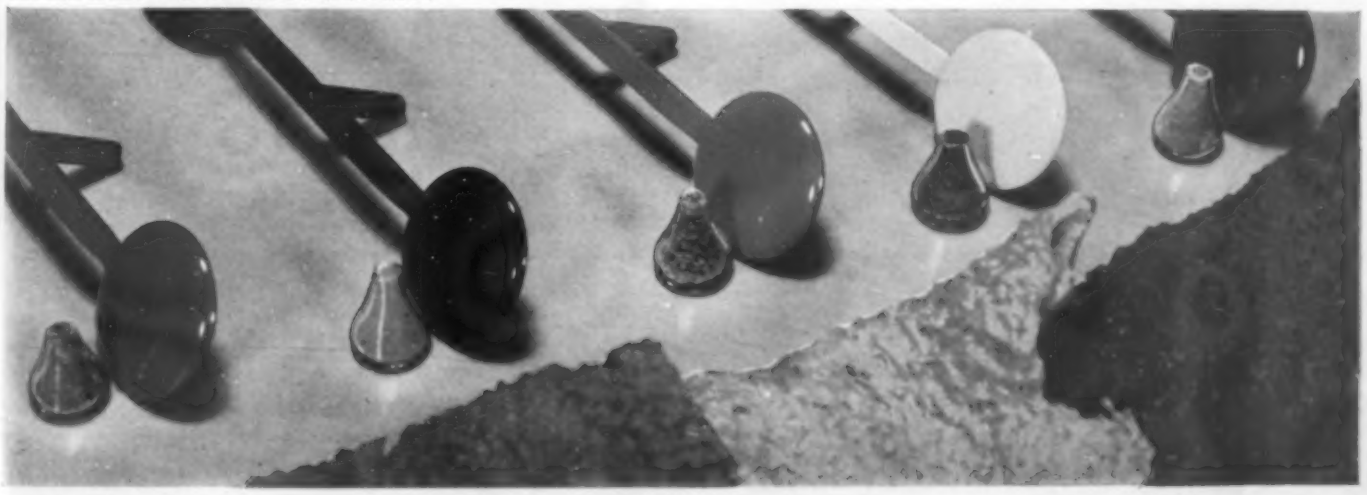
A susceptibility to thermal distortion is imposed on thermoplastics by definition—they are compounds which soften by absorbing heat and harden by releasing heat, and do so reversibly. The effect of this thermal softening varies widely among thermoplastics. Certain plastic materials which must be plasticized to reduce their viscosity at forming temperatures are more susceptible to plastic deformation at room temperature. On the other hand, certain unplasticized types—polystyrene for example—have a sharp break in their flow versus temperature curve. Consequently, they can be formulated for high resistance to plastic deformation at normal temperatures without impairing flow at the higher temperatures that are used in forming processes.

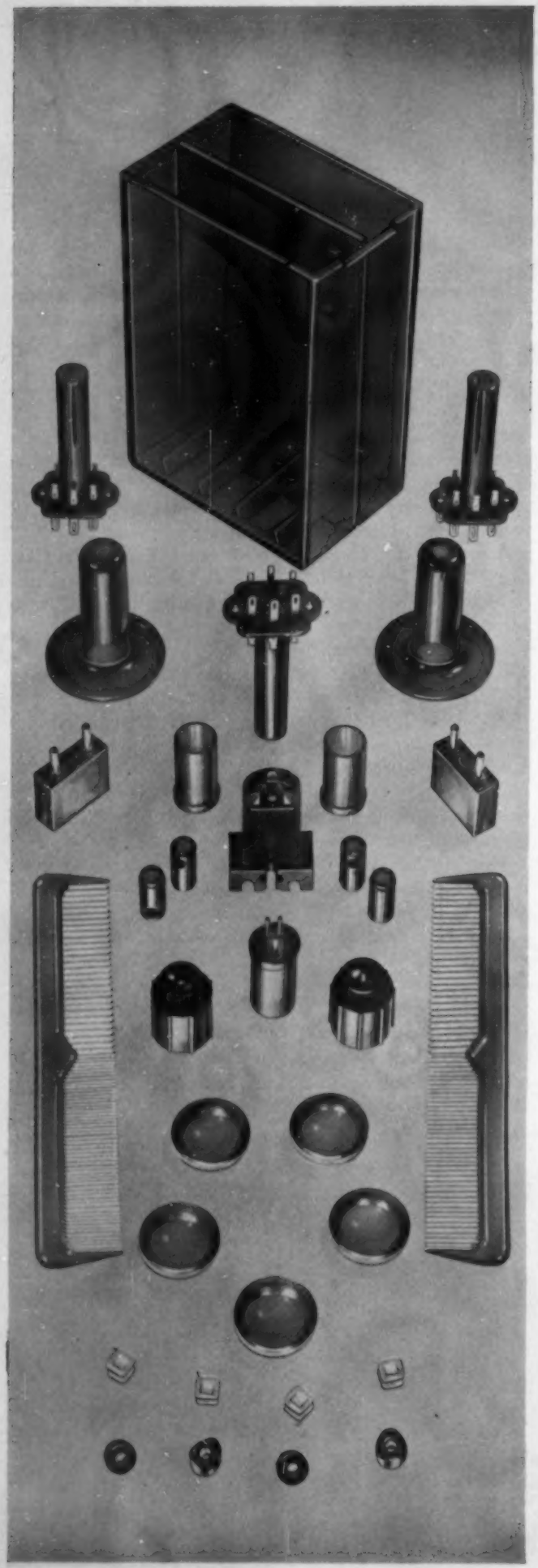
The cellulose esters and ethers must be plasticized to be moldable and suffer rather heavily from all three of the disadvantages listed above. Water absorption is relatively high, and the heat distortion point of the hardest moldable grades is approximately 210° F. The vinyl-type materials, such as polystyrene, the acrylates and the rigid vinyl chloride-acetate copolymers, are generally superior to the cellulose esters and ethers for dimensional stability. They do not require plasticization to induce moldability, and moisture absorption is relatively low. Certain members of the group,

* Manager of product development, Plastics Division, Monsanto Chemical Co.

1—*This new thermoplastic material can be formulated in a wide range of transparent, translucent and opaque colors*

ALL PHOTOS IN THIS ARTICLE, COURTESY MONSANTO CHEMICAL CO.





notably polystyrene, combine these advantages with high resistance to plastic deformation at moderate temperatures. However, all members of this group lose strength and form stability at service temperatures in the neighborhood of 200° F. or lower.

Cerex also has the advantages of low moisture absorption and zero plasticizer content. However, its principal advantage is that it removes the prime deterrent to a broader use of thermoplastics—low heat resistance. The injection molder can now compete for many applications formerly restricted to those handling thermosetting plastics. This fact is well evidenced by observing the effect of immersion of molded parts in boiling water. In effect, this is an accelerated test for severe service conditions that involve the composite effect of high temperature and high humidity. These combined conditions create an environment that is one of the most difficult for existing thermoplastic or thermosetting materials. Table I gives data obtained from the 48-hr. boiling of compression-molded disks of a general-purpose phenolic, general-purpose urea and Cerex formulation X-214.

Although this new family of resins comprises formulations with heat distortion points ranging from 195 to 300° F., early developmental work has been confined to the X-214 formulation which has a heat distortion point of approximately 225° F. The thermal, mechanical and electrical characteristics of this resin are described in Table II. It will be noticed that the mechanical properties of this new resin are fully equivalent to those of polystyrene, if not somewhat superior, and that its dielectric strength is excellent—superior to the electrical grades of phenolic molding compounds. The dielectric constant and power factor are also superior to electrical grade phenolic materials although inferior to polystyrene. A.S.T.M. arc resistance is similar to polystyrene—in the neighborhood of 70 seconds.

This new resin retains the excellent chemical resistance of polystyrene, and molded parts can be boiled in battery acid for a sustained period with no appreciable effect. Although soluble in aromatic and chlorinated hydrocarbons, the resin is insoluble in aliphatic hydrocarbons. Work is continuing on specific chemical resistant properties.

At the present time, the X-214 formulation is being manufactured in limited quantities on a pilot plant scale. All of the resin produced is going directly into war applications, and experimental quantities for postwar developments cannot be made available. Actual and potential wartime applications for the compounds include: coil forms, condenser cases, battery jars and accessory parts, connector inserts, crystal holders, instrument panel light domes, switch parts, surgical instruments which require sterilization, and other applications which cannot be divulged because of their secret nature.

Projected postwar uses include: plumbing, hardware, tableware, electronic instrument parts, surgical instruments, buttons, sterilizable combs and a multitude of other uses where the retention of form stability and strength properties at elevated temperatures is important. As produced at the present time, the resins range in color from a transparent light amber to a dark amber. However, since they are compatible with the usual dyes and pigments, it is possible to produce molding powders having a wide range of color in transparent, translucent and opaque shades. (*Please turn to page 166*)

2—While most of the experimental parts molded of this new thermoplastic material have been electrical or radio components, the plastic has been injection molded on standard machines in many different production molds

BETTER BRUSH WORK

IN the freight room of any big hotel where once stood a decorous wardrobe trunk or two, big wooden crates are piled high with names of military owners printed in that curious elliptical style which is a tradition of stencil makers. Strange addresses like New Guinea and the Fiji Islands give the impression that the owners must have returned from a scientific fauna-hunting expedition in the South Seas, until you see that all are addressed to Lieutenant, Captain, Ensign or even to humble Private Higginbotham. How overjoyed Private Higginbotham will be when he sees at long last his returning crate of souvenirs and the grass skirt he bought in Honolulu! Endless lines of military trucks rumble along with returned crates like Private Higginbotham's, or with outgoing military equipment. In short, the war has made the stencil brush an indispensable piece of equipment in the moving of military baggage.

Although the war has made stencil brushes indispensable, it has at the same time cut off the traditional material from which these brushes were always made—metal. Scarcity of metal forced many manufacturers to look for a new material. The Diagraph-Bradley Stencil Machine Corp. of St. Louis decided to experiment with plastic materials, since plastics were both cheaper and lighter than the metal formerly used for the brushes.

The company's first development brush was machined, not molded, of cellulose acetate. They then decided to mold the brush and turned to a local molding company to design a mold, help select a material and do the job. The molding company experimented for three or four months with various plastics, keeping in mind the different properties of the various materials as they related to the specific requirements of the finished parts. Their problems were: 1) the corrosive action of the ink on the plastic, particularly the ink used for metal stencils, 2) brittleness and 3) a certain amount of water absorption. Canvas-filled phenolic, for instance, would have been too absorbent, and woodflour filled and mica-filled phenolic proved less satisfactory than the cotton flock-filled phenolic finally adapted.

The 4 brush parts (ink chamber, head, ferril and push button—see Fig. 2) are all compression molded. At the beginning of their experimentation the company changed from flash type molds to full positive molds for the ink chamber and head to get maximum material density.

When they made the change from metal to plastics, the Diagraph-Bradley Corp. felt that the time was ripe for a new design, too, in stencil brushes, and their product development engineer, Otto Herb, designed a brush with altogether new mechanical features. The two most important features of Mr. Herb's brush are 1) that the ink is free flowing and cannot jam because there is no vacuum, and 2) that the brush has a plunger in the head which force feeds ink directly into the bristles instead of depositing it on the vulcanized heel.

The free-flowing feature of the brush is achieved by a long metal stem running the length of the ink chamber. A valve on the stem at the top of the chamber admits air when pressure is exerted on the push button. The diameter of the stem above the valve is narrower than that below the valve, and the pressure of the push button pushes the narrow part of the stem into the valve. As the narrow stem enters the valve, air fills the space between the stem and the sides of the valve, and seeps down through the valve into the ink chamber. The pressure of the air causes a continuous flow of ink, whereas in the old brush an air vacuum often stopped the flow and necessitated shaking the brush.

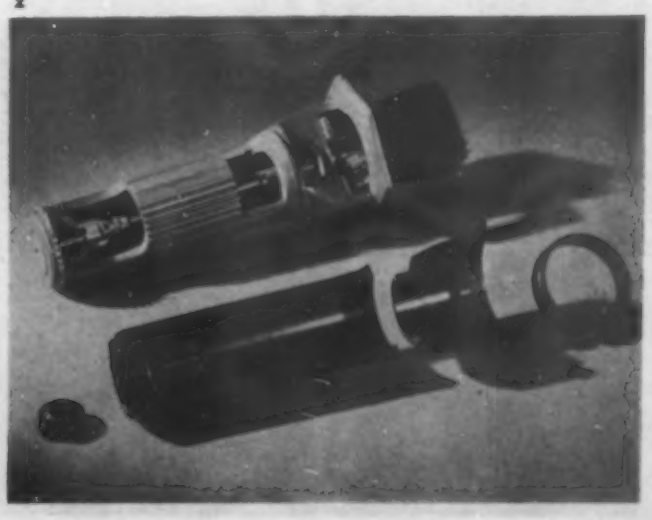
The second important feature of the brush is that ink is deposited directly into the midst of the bristles by a metal plunger which is a continuation of the stem and which moves up and down with the pressure of the push button. In the old brush, ink was deposited on the vulcanized heel of the bristles above the ferril.

Another improvement of the new brush is that the ferril into which the bristles are cemented (*Please turn to page 162*)

1—The plastic stencil brush (foreground) is both cheaper and lighter than the prewar metal brush (background). In changing over from metal to plastics, the unit was redesigned to achieve freer flowing of the ink, improved ink distribution and easier operation. 2—All 4 plastic brush parts are compression molded. The intricacy of the assembled unit is clearly evident in the cut-away sample which appears in the background of this photograph

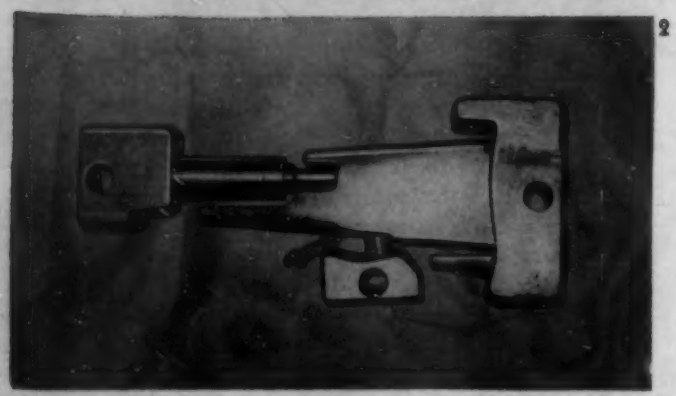
1

2

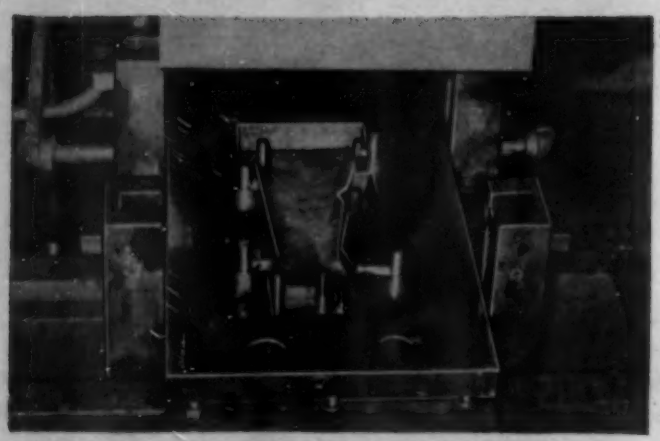


ALL PHOTOS, COURTESY FIRESTONE RUBBER AND LATEX PRODUCTS CO.

1



2



3

4

GUN BUTTS

FEW uses of plastics in the war have proved as successful under the toughest possible conditions as the gun butt stock on the familiar Browning semi-automatic rifle, a weapon which has served with distinction in both world conflicts. Equivalent in fire power to five M-1 rifles, the Browning can be mounted on a bipod for operation by a 3-man team or fired from the hip by moving troops. Since present tactics of the infantry squad are built around the principle of advancing this automatic rifle to the point of stiffest resistance, the weapon must withstand the most severe treatment and keep on firing.

Salt water immersion in landing operations, the steamy atmosphere present in jungle fighting and below-zero temperatures on northern battle fronts are among the conditions encountered by the Browning which prompted the search for a material to replace wood for the gun butt stock. As early as 1940 the Army, visualizing the new and widely differing conditions under which this standard infantry weapon might be used in combat, came to the conclusion that a new gun butt material was necessary—a material which would 1) be impervious to combat gases, 2) resist the action of slime and fungus growth that is characteristic of tropical climates, 3) meet high-impact strength requirements, 4) withstand extreme variations in temperature, and 5) meet the exacting requirements of weight and balance that are necessary if the gun is to operate at maximum efficiency.

Certain specific grades of walnut had always been used for the butt stocks, but the material had several shortcomings. Among these was the wood's tendency to split with the grain when subjected to great shock. This failing and the need for increased production were among the factors which influenced the Ordnance Department to investigate the possibilities of using plastics for this critical assignment. There were criteria, of course, upon which to base the belief that plastics might solve the problem. In the past, shotgun stocks had been molded of this material. However, these were sporting arms which were never subjected to grueling use.

At this point a New England molder was called in and an exhaustive engineering study undertaken to create a gun butt stock design which would, above all, meet the functional and weight requirements of the Browning semi-automatic. An experimental mold was constructed which was not required to meet any drawing tolerances except where the molded piece joined the barrel of the rifle. When parts produced in this die indicated that plastic gun stocks could be molded to meet the weight and service requirements, work was begun on a transfer mold.

Meanwhile, materials manufacturers were invited to sub-

1—The gun butt in the foreground is ready for shipment. The part in the background shows the appearance of the stock just after it has been knocked out of the mold and the core plugs removed. 2—The 3 interlocking core plugs that mold the inside of the gun butt. 3—Lower half of the mold cavity before the plugs have been inserted. 4—With the loose core parts assembled in the mold cavity, preforms are loaded into the transfer pots

FOR THE BROWNING SEMI-AUTOMATIC

mit samples of an impact material which would meet Army specifications for a gun butt and, at the same time, fill the molder's production needs. After numerous tests, two rag-filled phenolic impact materials were selected which, with modifications in color and in certain characteristics that made them adaptable to transfer molding, are still being used. Results of preliminary tests conducted at the Springfield Armory and the Aberdeen Proving Ground on the first production run of 100 butt stocks were so satisfactory than an order was placed for 6 molds even before final tests were completed. Since actual production started in October 1942, many thousand gun butt stocks have been molded each month. The rate was increased recently when additional molds were placed in production.

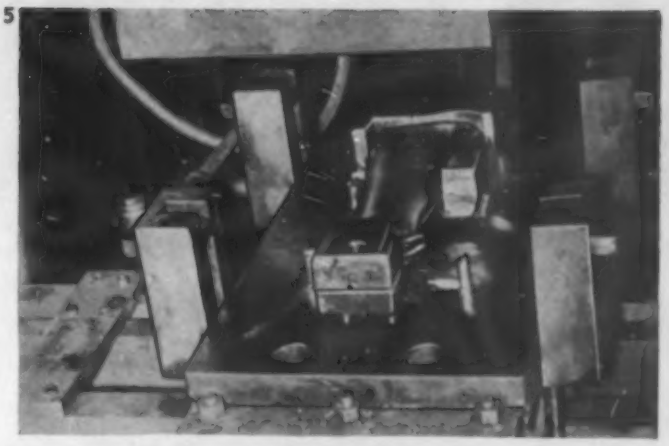
Transfer molded in 450-ton presses, the finished gun butt stock (Fig. 1) weighs 17 oz. and has a wall thickness of $^{5}/_{32}$ inch. However, one mold has been modified to produce a wall thickness of $^{3}/_{16}$ inch. The original experimental mold was designed with four transfer pots to assure a full flow of the material and to eliminate any danger of the part weakening at weld points. It is interesting to note that the only change in the production molds was a reduction in the number of pots after test runs proved that three were sufficient to obtain the desired flow.

The part as it appears just after it has been knocked out of the mold and after the core plugs have been removed is shown in the background of Fig. 1. The three projections—two at the shoulder end and one at the gun end—are the runners which channel the material from the three transfer pots to the cavity of the mold. The under sides of these runners, which act as knockout points, plus additional knockouts that act against the removable cores, permit the entire unit to be removed from the cavity without having any knockout disfigurations on the molded piece itself.

Figure 2 shows the three interlocking core plugs that mold the inside or hollowed-out surface of the gun butt. These core parts nest into position in the lower half of the mold cavity which is shown without the core pieces in Fig. 3. Figure 4 is a close-up of all sections of the mold. The loose core parts have been assembled in the lower half of the cavity and the operator is loading the preforms into the transfer pots. The transfer plungers can be seen directly above the operator's right hand.

The phenolic material used in the molding of this part weighs from 770 to 780 gr. per shot. One preform press feeds the preforms to the four men who operate the six molding presses. These presses are operated three shifts a day, seven days a week. No attempt is made to preheat the preforms in an oven since this procedure (*Please turn to page 174*)

5



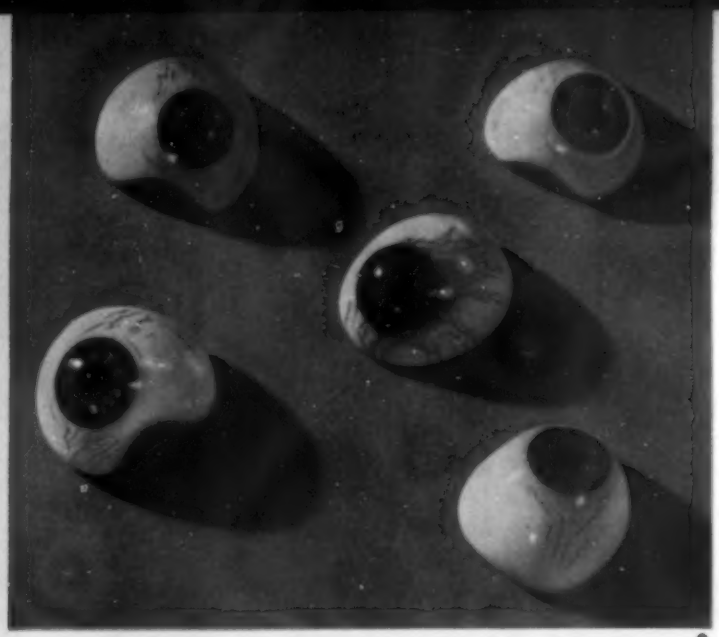
6

7

5—When the mold is opened, the gun butt and the 3 core pieces are pushed up from the lower half of the cavity by means of knockout pins attached to the 3 knockout bars which extend from left to right in the center of the photograph. 6—The core-removing apparatus consists of a holding jig which grips the gun butt, and 3 hand levers that engage with the 3 core plugs. 7—A wet sander completely removes the flash and all signs of split lines

PHOTOS, COURTESY DR. SIDNEY O. NOLES

1



2

1—Even the most discerning would hesitate to hazard a guess as to which is the plastic and which the natural eye. The slightly relaxed muscles around the eye on the right are almost the only indication that this is the artificial eye. *2—The acrylic eyes can be produced in a wide range of colors to match natural eyes*

Acrylic for artificial eyes

BACK in the days of the Revolutionary War, soldiers home from the wars may not have objected to wearing a black patch in lieu of an eye. But World War II heroes returning partially blinded from wide-flung battle fronts may be more sensitive. Today the 300,000 or so persons in the United States who wear artificial eyes will never know how close they came to having to revert to this old practice. For glass eyes are numbered among such war shortages as rubber tires, brass buttons, beef and beverages.

If modern science, tremendously accelerated by wartime demands, had not developed the various forms of plastics from which thousands of war- and peacetime products are now being made, attention-compelling black patches would probably have become more and more numerous on American streets. On the roll of honor for overcoming this wartime shortage is the name of Dr. Sidney O. Noles of San Francisco, doctor of optometry and graduate artificial eyemaker.

Dr. Noles is believed to be the only American-born, German-trained artificial eyemaker in the United States. The story of his work goes back to the last World War, when his father, an optician, had difficulty in securing sufficient glass eyes for his patients. For over one hundred years, German glass makers had manufactured the tubing used to make the stock glass eyes for world exportation. To break this German monopoly, the senior Noles sent his son to Europe to learn this highly specialized art. There he found it almost impossible to crash through the closed gates of the eyemakers' guild until he found one man who, for a price, was willing to reveal the secrets of the trade.

As World War II approached, Dr. Noles saw that there was going to be another shortage of artificial glass eyes. To find a substitute, he first spent arduous hours studying chemistry at night school. Subsequently he took a university degree and finally a degree in optometry. After considerable study and experiment, Dr. Noles at length decided that plastic was the answer to the looming shortage of this particular variety of glass.

This comparatively new product, the plastic eye, has all the qualities necessary for an artificial eye and has been found to resist body acids and deterioration much better than the glass eye. In his two and one-half years' work with plastic eyes, Dr. Noles has not had one returned for repairs or because of flaws. The plastic eye so closely resembles the natural eye that it is difficult to detect the difference when it is worn (see Fig. 1). Since the basic acrylic resin used for forming the eye is crystal clear, it is possible, by adding pigments and dyes, to produce molding powder ranging in color from very delicate tints to deep shades.

The process of making the plastic eye may be divided into three stages: molding, implanting the iris and veins on the blank, and the final finishing. A mold is made in a hollow steel two-part flask with an artificial eye used for the "set-up" in stone-type plaster (Fig. 3). The monomer is then added to the plastic powder to create a wad about the consistency of putty, which is squeezed into shape in the mold.

Approximately 2000 lb. of pressure is applied by means of a steel clamp press on the mold. When the mixture has set, the mold, still in the clamp, is cured in boiling water for half an hour. After the cooling period, a hardened plastic blank has been procured in the shade of the sclera, or white of the patient's eye (Fig. 4). The blank is now ground at various angles and prepared for the impression of the iris and veins.

Since a finished eye was used to make the mold, the blank is rounded on top as it comes from the mold. In order to place the iris on this blank, a table or plateau is ground off. The iris segment which is colored on a wafer as a separate unit is then countersunk into the body of the blank. After the veining has been painted on the blank by hand and the iris placed on the plateau, a clear plastic is applied. When the blank has again been placed under pressure in the mold, this newly applied plastic flows up over the iris in the original curved shape and forms the convex cornea of the eye.

The last stage of the process includes the trimming off of the overlap (Fig. 7) and a semi-polish. The eye then is ready to be tried for seating and position in the socket, after which it is shaped and ground off. The final step is to polish the

3—For setting up the mold, an artificial eye is embedded in stone-type plaster. **4**—*After curing, the hardened plastic blank is removed from the mold.* **5**—*The iris has been implanted in this artificial eye and veining and coloring applied by hand to secure a lifelike effect.* **6**—*Appearance of the plastic mold as it comes from the press.* **7**—*Excess material must be ground off the eye*

surface lightly for permanent wearing (Fig. 8). Tools used for the polishing and grinding are the usual table type of motor-driven buffer and etcher which are employed by dental laboratories.

Before the present war those who wore an artificial eye used one formed of glass. There was no alternative. And because of the limited number of men qualified to make glass eyes (there are approximately 20 in the United States), there was a greater demand for individually made eyes than the eyemakers could possibly produce. Plastic eyes are, therefore, most timely replacements.

One of the outstanding advantages of the plastic eye is the almost unlimited variation possible in its coloring. It is estimated that there are 800,000 different shades of the human eye. The distinction may often be a fine one, but it is most important to the man or woman who is forced to substitute an artificial eye for a natural one. It is possible to mix the colors for the plastic eye while the patient is present. Thus, blue is added for children; green for adults; cream for the Latins; and a deep nicotine for Negroes, Polynesians and Hawaiians. By this means the white outer coat of the natural eyeball can be closely duplicated.

Comfort is an important item in artificial eyes. Plastic eyes have been found to move more readily in the socket than glass, can be made to fit more closely and, since they are softer in texture, are more amenable to the delicate tissues of the socket.

The safety factor is another of the reasons for the popularity of the new product. The plastic eye is practically unbreakable, while that of glass was most fragile; dropping does not damage the former but usually means the destruction of the latter. Occasionally the glass eye, since it is closed under partial vacuum, explodes. Sudden changes of temperature may cause this type of breakage, and a serious accident may result if the wearer goes abruptly from a low to a high temperature.

A plastic eye which has been worn for six months may be repolished so that it looks like (*Please turn to page 168*)

A new dielectric for cables*

by HUGH C. CRAFTON, JR.,† and HARRY B. SLADE‡

CONSIDERABLE research and development work has been carried on in recent years with a view to meeting the many new requirements and urgent needs of the present emergency. In this connection, the development and use of polyethylene, also known as Polythene, as a flexible insulation is of particular merit. Consumption of the commercial product is rigidly restricted to specific military needs. However, in spite of its limited distribution, both the scientific and technical aspects of polyethylene have been rather extensively investigated.

The development which has proved to be of greatest technical and commercial importance is described in the British patents[1] (9) issued in 1937 to Fawcett et al., and assigned to the Imperial Chemical Industries, Ltd. Other patents (10, 11) followed. Semi-solid and solid (Polythene) polymers having melting points of 110–125° C. and molecular weights of 3000–40,000 were obtained by varying the reaction conditions—temperature, pressure and concentration of oxygen (catalyst). The conditions for the production of a satisfactory commercial product are reported to be a pressure of approximately 1500 atmospheres, 150–250° C. and an oxygen concentration of about 0.08 percent. The reaction is extremely exothermic and relatively rapid. Consequently, it is necessary to provide an autoclave in which excessive and localized overheating can be prevented. The melting point and molecular weight of the products increase with increase in pressure and vary inversely with the temperature and catalyst concentration. The latter is rather critical for each pressure and temperature, and must be very carefully controlled to avoid explosive reactions.

Polyethylene has been commercially available from two sources in this country since 1942. The method of polymerization employed by manufacturers and the production capacity have not been disclosed. However, it is known that the process is similar in nature to the extremely high-pressure process described in the British patents (9) previously discussed. Because of its pre-eminent dielectric characteristics and other properties, polyethylene has been utilized almost exclusively as an electrical insulation—particularly on wires and cables.

Structure and properties

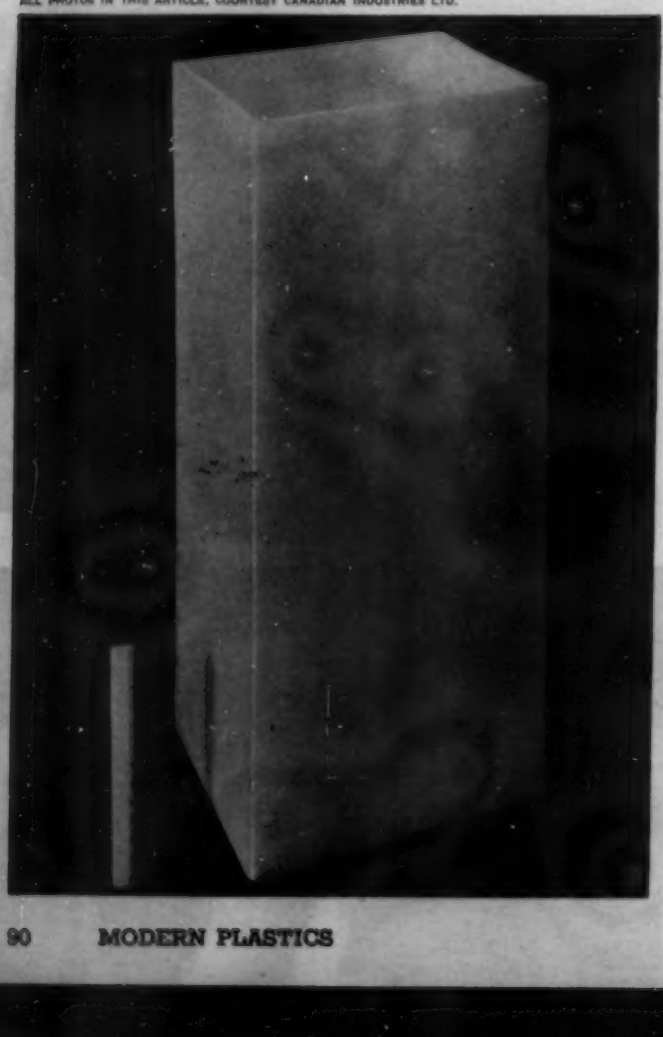
Polyethylene is composed of chains of (CH_2) groups which exhibit a high degree of electrical symmetry. In other words, polyethylene is an almost completely non-polar substance. Therefore, any changes in the dielectric properties with changes in frequency and temperature, which may be observed, would probably be due mainly to traces of impurities.

The general nature and properties of polyethylene have

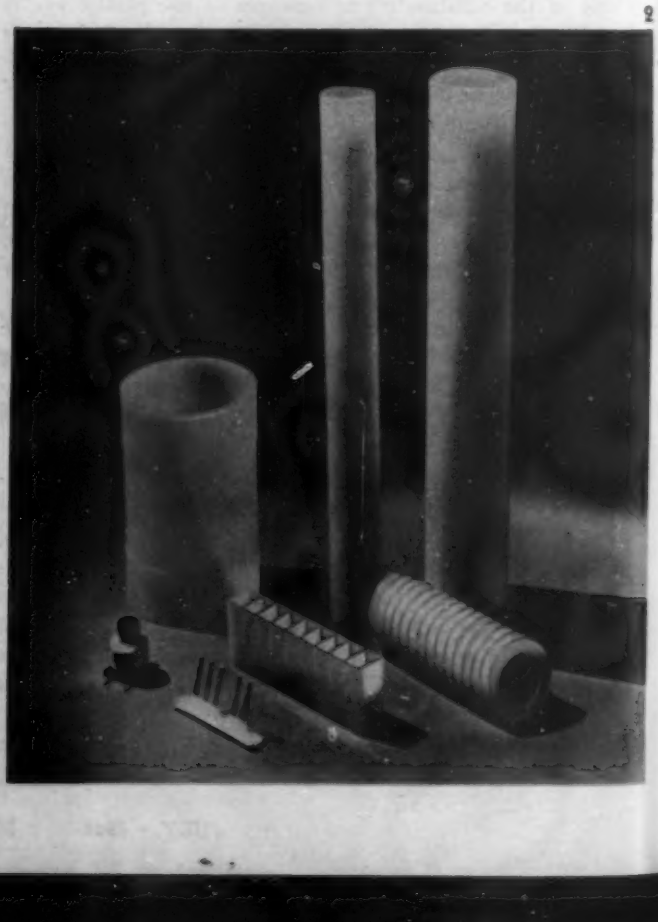
* Presented before the Annual Conference of the Society of the Plastics Industry, Chicago, Ill., May 12.
† Research chemist, Okonite Co.
‡ Research engineer, Okonite Co.
[1] The numbers in parentheses refer to the Bibliography at the end of this paper.

ALL PHOTOS IN THIS ARTICLE, COURTESY CANADIAN INDUSTRIES LTD.

1



2



1—A large container made by extrusion molding. 2—Examples of moldings and of parts machined from rods. The samples in foreground were made by injection molding

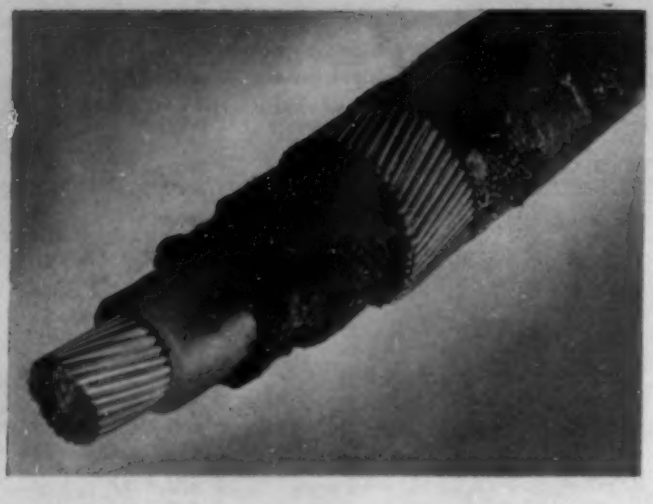
been discussed by several authors (9, 10, 37, 38, 39, 62). It is a white waxy translucent material, tough and flexible (but not rubbery) in thin sections. Yet it resembles rigid plastics when formed in thicker sections. The mechanical behavior of polyethylene places it in a unique intermediate position in the realm of synthetic plastics and elastomers.

The data given in Table I on the electrical, mechanical, thermal, physical and chemical characteristics of polyethylene

TABLE I.—PROPERTIES OF POLYETHYLENE AND THREE OTHER INSULATING MATERIALS

Property	*Polyethylene*	*Polystyrene*	*Polyisobutylene*[a]	*Rubber*[b]
Dielectric properties				
Dielectric strength, v/m	600–1000	500–700	400–500	500–700
Volume resistivity, ohm.-cm.	10^{17}	10^{17}–10^{19}	10^{16}	10^{15}–10^{16} (r, v)
Dielectric constant at:				
60 c/s	2.3–2.4	2.5–2.6	2.2–2.4	2.3–2.5 (r) 2.4–2.9 (v)
10^3 c/s	2.3	2.5–2.6	2.2–2.4	2.3–2.4 (r) 2.7 (v)
10^6 c/s	2.3	2.5–2.6	...	2.3–2.4 (r) 2.4–2.7 (v)
Power factor, at:				
60 c/s	0.0002–0.0005	0.0001–0.0002	0.0002–0.0005	0.002–0.003 (r) 0.004 (v)
10^3 c/s	0.0002–0.0005	0.0001–0.0002	0.0002–0.0005	0.001–0.002 (r) 0.004 (v)
10^6 c/s	0.0002–0.0005	0.0001–0.0004	...	0.001–0.002 (r) 0.004 (v)
Temp. dependence of dielectric properties	small	small (to 70° C.)	small	small
Mechanical properties				
Tensile strength, p.s.i.	1600–2000	3500–7000	285	130–350 (r) 3200–4200 (v)
Modulus of elasticity, p.s.i.	0.15×10^5	1.7–4.7×10^5	[d]	[d]
Elongation, percent	300–500	2–5	1000	1000–1200 (r) 700–800 (v)
Rockwell hardness	R 13	R 90–R 97	[d]	[d]
Flexural strength, p.s.i.	1700	8000–19,000	[d]	[d]
Impact strength, ft. lb./in.	[e]	0.2–0.5	[e]	[e]
Thermal properties				
Softening point, ° C.	104–115	116–130	≤ 0[f]	≈11 (r, v[f])
Transition temp., ° C. below	−45	82	−50	−60 to −62 (r, v)
Distortion temp., ° C.	50[g]	75–80	...	...
Specific heat, cal./gm./° C.	0.5–0.68	0.32	0.45	0.45 (r) 0.51 (v)
Coeff. of thermal expansion per ° C.	7–8.3×10^{-4}	1.8–2.4×10^{-4}	...	6.7×10^{-4} (r) 6.6×10^{-4} (v)
Thermal conductivity, cal./cm.²/sec./cm./° C.	7×10^{-4}	1.9–3.2×10^{-4}	...	3–3.8×10^{-4} (v)
Burning rate	low	low	medium	medium
Physical properties				
Specific gravity, gm./cc.	0.92–0.95	1.05	0.91–0.95	0.91 (r) 0.92 (v)
Refractive index, n^{25}_D	1.52	1.59	1.51	1.52 (r) 1.53 (v)
Water absorption, percent	0–0.01	0–0.08	0+	2–4
Permeability,[h] gm./hr./cm.²/mm.-Hg/cm.	1.5–0.7×10^{-6}	3.7–4.3×10^{-6}		6.7–7.9×10^{-5}
Tendency to cold flow	slight[i]	very slight	very great	nil (v)
Chemical properties				
Acids	none	none	none	is attacked (r, v)
Alkalis	none	none	none	is attacked (r, v)
Oxygenated solvents	none	soluble	swells	slight (r, v)
Oil, hydrocarbon solvents	none[j]	soluble	soluble	soluble (r) swells (v)
Heat (oxidation)	none[k]	slight	none	considerable (r, v)
Ozone	none	none	none	is attacked badly (r, v)
Sunlight	none	none	none	considerable (r, v)
References	27, 37, 39, 42, 55	46, 47, 48, 49, 50, 53	42, 47, 54, 55, 56	47, 51, 52, 53, 54, 55

[a] Average molecular weight—100,000.
[b] (r) and (v) refer to raw and vulcanized (2 percent S) rubber, respectively, in all the tables.
[c] No break at room temperature, 4 ft.-lb. machine (39).
[d] Very low, not comparable to plastics.
[e] Very high, not comparable to plastics.
[f] M. p. of crystalline state.
[g] At 66 p.s.i. load.
[h] To water vapor. Not strictly comparative due to different test techniques.
[i] Twenty percent at 50° C. and 1200 p.s.i. load.
[j] Is attacked above 60–70° C.
[k] Oxidizes above 100° C.



3—*This 440-volt power cable, which is insulated with polyethylene, has been in service for several years*

and, for comparison, of polystyrene, polyisobutylene and rubber, are taken both from the literature and from observations made in our laboratory. Unless otherwise stated, the values for the various properties are for room temperature. Some of the tests, designed specifically for plastic materials, do not give meaningful results for rubber-like polymers. Therefore, values for certain properties of polyisobutylene and rubber are omitted from the table. It must be realized that rubber is always compounded for use as a practical insulation and that polyisobutylene cannot be used alone.

The dielectric properties of these four polyhydrocarbons are very similar. The higher dielectric constant and power factor of rubber are chiefly a consequence of the non-hydrocarbon constituents. In vulcanizates the sulfur and compounding ingredients contribute to the dielectric losses.

TABLE II.—COMPARATIVE RATINGS OF POLYETHYLENE AND THREE OTHER INSULATING MATERIALS[a]

Property	*Polyethylene*	*Polystyrene*	*Polyisobutylene*	*Rubber*[b]
Dielectric strength	E	E	G	G
Volume resistivity	E	E	E	G
Dielectric constant	E	E	E	G
Power factor	E	E	E	G
Temp. stability of dielectric properties	E	E	E	E
Tensile strength	G	E	P	E
Modulus of elasticity	E	E	P	G
Elongation	E	P	E	E
Flexibility	G	P	E	E
Hardness	G	E	P	G
Impact strength	E	P	E	E
Resistance to cold flow	E	E	P	E
Distortion temperature	E	F	P	E
Brittle temperature	E	P	E	E
Non-flammability	P	P	P	P
Specific gravity	E	E	E	E
Low water absorption	E	E	E	G
Low permeability	E	G	G	F
Chemical resistance	E	E	E	P
Solvent resistance	G	P	P	F
Ozone resistance	E	E	E	P
Sunlight resistance	E	E	E	P
Heat resistance	E	E	E	G

[a] E = excellent, G = good, F = fair, P = poor.
[b] Refers to practical insulating compounds in general.

Polyethylene is superior to the other materials in its combination of desirable mechanical characteristics. The embodiment of toughness, flexibility and dimensional stability is ideal for insulations on electrical wires and cables. The unique nature of this material is further exemplified by its behavior over a wide temperature range (below −45 to 100° C.). Consequently, it may be employed in cases where both resistance to brittleness at moderately low temperatures and resistance to distortion at high temperatures are of prime importance. Of the four materials being compared, vulcanized rubber is the only other insulation exhibiting similar thermal characteristics.

The excellent physical and chemical properties of polystyrene and polyisobutylene compare favorably with those of polyethylene. The properties of rubber, in this group, are less attractive. The extremely low moisture absorption of polyethylene together with its permeability, chemical inertness and resistance to solvents (below 60–70° C.) are features which greatly enhance its value and extend its applicability as a wire and cable insulation.

The suitability of dielectric materials for electrical conductors must be judged from their behavior, depending on a large number of properties. An over-all picture for the four materials under discussion may be obtained from the comprehensive comparison given in Table II. It is conclusive to note that polyethylene is rated "excellent" for 18 and "good" for 4 of the 23 properties listed. (All are rated "poor" for flammability.) The superiority of polyethylene may be attributed to the characteristic features of the polyethylene chains. The most important of these are: 1) a homopolar nature; 2) an unusual combination of (a) a low specific molar cohesion and (b) a readiness to crystallize. Table II might also serve to indicate the numerous possibilities obtainable by blending, or compounding, each of the four polyhydrocarbons one with the other.

It is interesting to consider briefly several possible future developments. For example, the melting point of polyethylene is lower than would be expected from the equation of Meyer and van der Wyck (59) for normal paraffins. As the chain of C-atoms of normal paraffins becomes very large, the melting point approaches a limiting value of 145° C. which is higher than the observed value for polyethylene. This does not explain the anomalous fusion phenomena of polyethylene and other long-chain molecules, but it may suggest that a higher melting point polyethylene is possible. In addition, it seems likely that the rubber-like state might conceivably be extended over a wider temperature range (in contrast to a sharp melting range). The accomplishment of this end may rest on the possibilities of future developments in the polymerization process which would yield polymers differing in the nature of their molecular weight distribution and/or having a higher average molecular weight. Furthermore, minute amounts of suitable cross-linking agents might be used to advantage. Such products would be expected to possess, among other things, very interesting high-temperature characteristics for specialized applications.

Insulated cables

The extrusion of polyethylene on conductors has been and still is an interesting problem. The early I.C.I. British material was of the sharp melting point variety—probably by reason of a narrow molecular weight distribution. Its characteristics were such that at 102° C. it was tough and non-plastic but at 106° C. it was a molasses-like liquid. Between these temperatures the material went through a plastic state where it could be handled like normal plastic materials.

As a result of the difficulties experienced in trying to extrude pure I.C.I. polyethylene, a variety of methods was tried, even including the use of a modified type of lead press. In the end, however, partly to broaden out the narrow plastic range and partly to aid in low-temperature flexibility, polyisobutylene was added to the polyethylene. The composite insulation has been in general use for some time—extruded by conventional rubber tubing equipment, fed from rubber mixing mills.

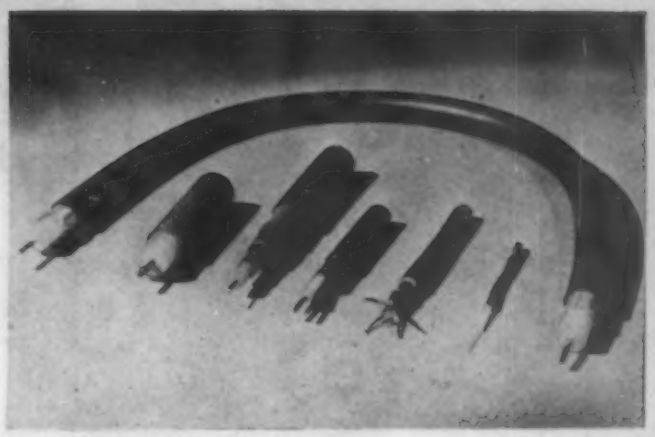
There are two sources of polyethylene in this country, and the material produced is quite different from the I.C.I. polyethylene. In the first place, it has a higher molecular weight than its predecessor and, secondly, the range of molecular weight distribution seems to be greater. The resulting polyethylene has plastic properties over a greater temperature range, a characteristic that aids materially in extrusion; and the low-temperature brittle point is considerably better. All material for cable insulation contains an anti-oxidant by reason of the fact that it is not always possible to prevent prolonged heating and subsequent oxidation of the material during processing, and the small amount of anti-oxidant used is well worth the slight sacrifice in initial power-factor increase.

American polyethylene, with its better plastic properties, greater flexibility range and stability to heat, can be handled on either rubber or plastic extrusion equipment without the need of additional softening materials. For the best results, however, the material is fed cold in pellet form to a plastics tuber and processed only once rather than being milled for an uncertain time and then fed to a tuber. The rigidity of cold polyethylene and the great volumetric contraction from the extrusion temperatures down to room temperature (12–14 percent) make gradual cooling of insulated wire necessary in order that the outer surface may contract with the inner section. Too quick chilling of the outer surface causes it to become hard. The inner material then contracts outwardly, leaving voids next to the conductor (39). Proper slow cooling solves this problem and allows the single extrusion of heavy walls. The method of cooling and the time required are determined mainly by results obtained on finished cable. Loose insulation or the presence of voids next to the strands are located by corona (ionization) detecting voltage tests.[2]

About the only limitation on polyethylene for insulated cables stems from the fact that, being a thermoplastic with a softening point around 104° C., any outer coverings must be applied without heating the cable as a whole above this temperature for any appreciable time. This circumstance confines jacket coverings to thermoplastics or so-called self-curing vulcanizates. Actually, there are few if any jacket materials having better protective properties than polyethylene itself. Possible exceptions are flame-resistant materials and metallic coverings.

At the present time polyethylene is being used principally for high-frequency cables where its low losses and general physical and chemical properties are unequalled by any other material. Its use in this application also extends the supply of natural rubber still needed in military tires. As the production of polyethylene is now greater than the demand for high-frequency cable, many other uses are being developed. Foremost among them are radio, communication, control and submarine cables—all for military use. It is quite possible that power cables and outer protective jackets may be made from the material because of its excellent dielectric properties, ozone resistance, moisture resistance and chemical stability.

[2] The voltage stress in a cylindrical cable is greatest in the region next to the conductor. This becomes a useful fact from a testing standpoint, particularly where there is the possibility of air spaces near the conductor. In any series system under voltage stress, the voltage drops are inversely proportional to the capacities of the dielectrics involved. With air having its dielectric constant of 1 compared to 2.3 for polyethylene, the voltage across a void next to the conductor is roughly 2.3 times the voltage which would exist across the equivalent thickness of polyethylene. This accentuated voltage in any spaces next to the conductor causes ionization of the air which can be detected, and is of great assistance in testing cables. The magnitude of voltage at which corona appears at the conductor depends on the size of conductor, insulation thickness and the size of voids. In general, it is desirable to keep corona-starting voltages well above the proposed operating voltage.



4—Various types of high-frequency cables that have polyethylene insulation. The larger cable is protected on the outside by a sheath of plasticized polyvinyl chloride

Where extra-flexible cables are needed, polyethylene is at a disadvantage because in moderately thick sections it is quite rigid although capable of being bent without cracking. Vulcanized natural or synthetic rubbers generally are at a considerable advantage when used for portable cables that are occasionally subject to contact with hot metal. Where polyethylene would act in typical thermoplastic fashion and flow, vulcanized coverings or insulations would retain their shape.

In the field of vulcanized natural and synthetic rubbers, polyethylene has been tried as a compounding ingredient with considerable promise. Its use improves certain properties of an insulation to a degree that is out of proportion to the amount of the material that has been added, while other properties are benefited about in proportion to the amount used. Unfortunately, there has not been enough time or sufficient material available to study the effects thoroughly. However, there is much promise of the use of polyethylene in the future. Fortunately, the benefits derived do not seem to be obtained at the expense of other qualities. For example, ozone resistance in power-cable insulations, sometimes obtained by softeners, reclaimed rubber or polyisobutylene, is generally accomplished at the expense of toughness and deformation resistance. The toughness is increased along with ozone resistance by the use of polyethylene.

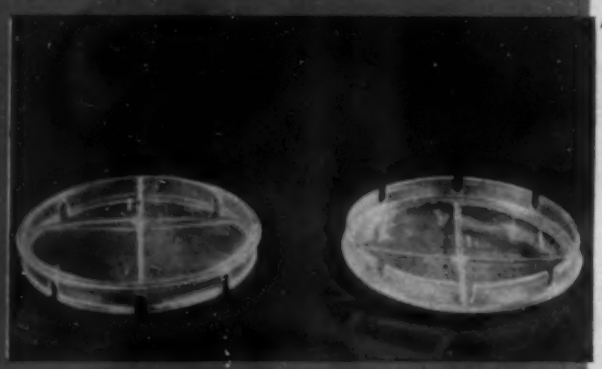
Before polyethylene was available in quantity in this country, solid dielectric high-frequency cables were first made with insulations containing high percentages of natural rubber. In working toward lower capacity and power factor, polyisobutylene-rubber insulations were made—usually vulcanized. A big step forward in low-loss insulations came as the result of the use of polyisobutylene with stiffeners which included resins, cyclized rubber and sometimes polystyrene in combination with rubber or cyclized rubber. These insulations were developed to the point where their capacity and power factor were nearly as low as those presently possessed by polyethylene. But physically and chemically they could not compare with polyethylene and may now be regarded as valuable temporary expedients. They bridged a gap between cable demand and polyethylene supply and performed creditably while needed. Table III shows the development and shortcomings of various compositions. (*Please turn to page 168*)

PLASTICS

2

1

3



4

5

1 Sewing accessories are assuming a new importance in the consumer markets. Thimbles, especially, are appearing in many new materials—among which is Lumarith. These cellulose acetate thimbles, molded by the Modglin Co. at a pressure of 400°, have added wall thickness and vertical instead of honeycombed indentations

2 For continuous satisfaction under constant use, a soap dispenser must be both sturdy and transparent. These dispensers, injection molded of Tenite II by the Federal Tool Corp., meet both requirements. The 5-piece assembly consists of the two halves of the body, a lid, a joint-sealing strip and an agitator which meters out the correct amount of soap

3 Originally built for the shipbuilding industry, these $4^1/_2$-in. dial thermometers encased in Textolite have found a wide use in industries where an economical instrument is required for measuring temperature at a point remote from the medium. The thermometer is built to withstand severe operating conditions and the phenolic case provides additional protection against corrosion and shock. To simplify readings at a distance, the dial is finished in black with white figures. The case is molded by Plastics Divisions, General Electric Co., for the Taylor Instrument Companies

4 To permit quick inspection of rudder trim tab mechanism on planes, while protecting these working parts from any foreign matter, Douglas Aircraft Co., Inc., now uses rudder trim tab covers that are molded of transparent Vinylite. These caps, which are produced by the Plas-Tex Corp. in a single-cavity die at 350°, measure only $4^1/_2$ in. in diameter and $^{25}/_{32}$ in. in depth, and are so built that they snap snugly into place

5 Realizing that the human mechanism is not fully attuned to the difficult schedule of waking, working and sleeping that wartime production requirements have imposed upon it, the WPB has eased its restrictions on alarm clocks to meet a critical shortage. It now sponsors a war alarm clock of the same caliber as prewar timepieces, encased in an attractive ivory Plaskon

in REVIEW

6

housing. Molded and distributed by Plastics Divisions, General Electric Co., these cases are strong, light in weight and present an attractive finished appearance

6 No part of a plane is too insignificant to receive careful attention. Even such details as the switches for landing lights and the electrical system must be carefully shielded against damage and accidental movement. The clear Fibestos guards are injection molded by Plas-Tex Corp. for North American Aviation, Inc., in 4-cavity molds, 2 cavities for each part. They are designed to run across various length panels, in numbers ranging from 6 to 12. The transparency of these light-weight, durable guards makes panel lettering easily visible

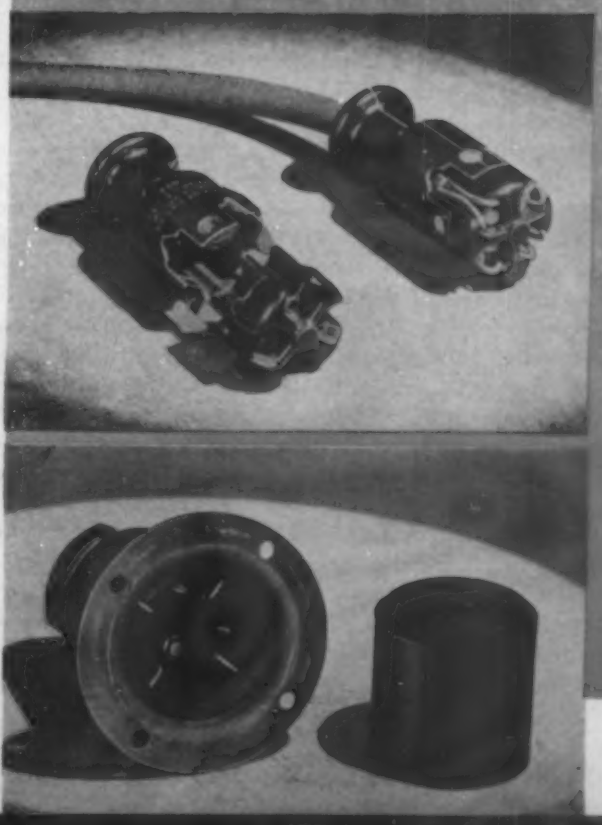
7 To eliminate any element of speculation when determining the concentration of substances in solution, chemists employ a highly sensitive photelometer or photo-electric device enclosed in a Bakelite housing. The housing is molded for Central Scientific Co. by Plastics Division, Molded Products Co., at from 10 to 15 cycles per hour, and is held to close tolerances

8 Immediate identification of different types of tools is now possible through the use of colored Tenite tags. Supplied in red, black, green and gold, the tags are used to differentiate between departments or classes of tools. The imprinting and filling are done in one operation on a hot press. A Vinylite printing die cast is shown in the center. Furnished in sheets, this plastic is handled like stamp rubber. These marking devices are produced by Winters Stamp Mfg. Co.

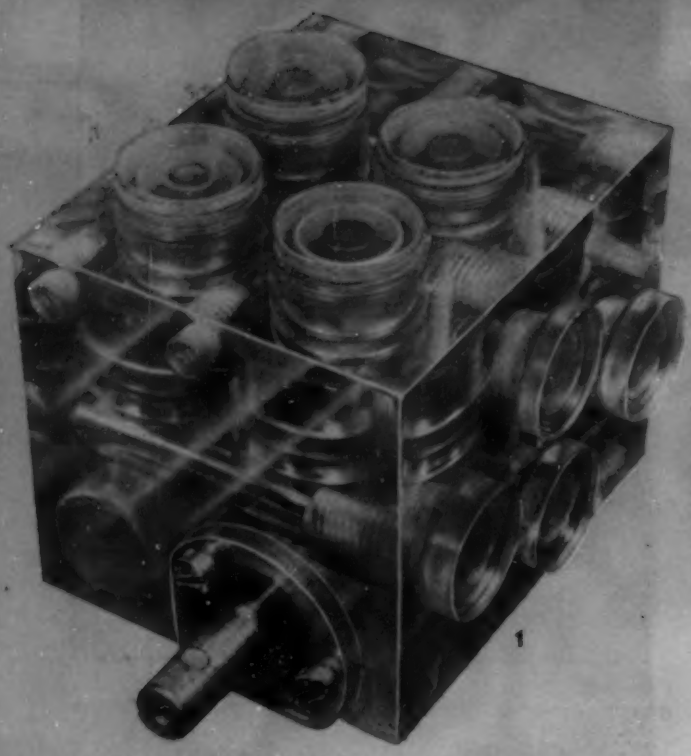
9 These connector plug and cable assemblies are used by many large commercial fleet operators and the Armed Forces on truck-trailer units. Two sockets—one installed in the truck, the other in the trailer, are joined together by a heavy 4-conductor cord which has a plug attached to either end. The plastic insert of the socket, which serves as an insulator, is molded of general-purpose Bakelite. The plug is molded in 2 parts of high-impact Bakelite or Resinox. Chicago Molded Products Corp. molds these plastic parts for Warner Electric Brake Mfg. Co.

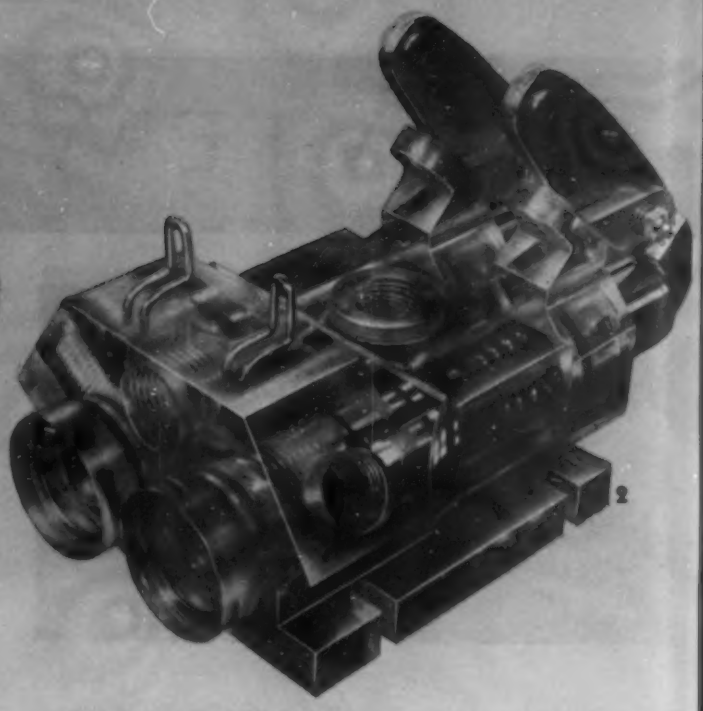
7

8



9





Outside looking in

ALL PHOTOS, COURTESY FORD MOTOR CO.

FACED with the necessity of accelerating the training of literally thousands of new workers, many of whom were without knowledge or experience in engineering or manufacturing practice, the Ford Motor Co. at its Willow Run Bomber Plant developed a system of teaching with the aid of acrylic plastic models which already has yielded astonishing results in increased efficiency.

This method of instruction is gradually being extended throughout the plant with a view to familiarizing students and workers with the intricate mechanisms that go into the construction of the B-24 Liberators which the company is turning out at a record rate. It has proved so successful that, in time, transparent plastic models of practically every assembled or functional part in the huge Liberators will in all probability be available for display and instruction.

Proceeding on the assumption that if a transparent plastic bubble in the nose of a bomber assists a navigator in plotting his course through the heavens, a block of the same substance surrounding a metal part should enable a student to see the inner workings of the bomber's parts, experiments were started in the construction of models of such parts as the fuel selector valve, engine-driven hydraulic pump and hydraulic hand pump. It was found possible to machine blocks of acrylic plastic to exact specifications for assembly with other plastic parts or with functional metal parts. The transparency of the acrylic plastics allows the interior workings of the bomber mechanisms to be seen in their true perspective without recourse to prismatic projection by engineers. Consequently, instructors are able to explain in step by step detail the individual functioning of each unit and to demonstrate its relation to the whole mechanism.

There are several factors which make acrylic plastics singularly well suited for the manufacture of working models. Their transparency is, of course, the outstanding feature, but the ease of machining and the facility with which they can be brought to close tolerances in manufacture, make it possible to utilize actual metal parts as inserts in the models.

For example, one of the most troublesome parts to explain is the fuel selector valve (Fig. 6) for the huge Liberators. The valve is roughly hexagonal in outside design with lines leading into a central union from three directions. Poppet valves are located at the two inlet ports of the valve. Elaborate charts and drawings and a basic knowledge in the reading of blueprints and drawings were necessary when the functioning of this part was demonstrated by conventional methods. A cut-away teaching model did not answer the problem, for it did not show with sufficient clarity the manner in which the poppet valves operate in relation to the whole assembly. It was necessary for the instructor to try to make his students visualize what was taking place inside the valve at any given moment.

A model of the fuel selector valve was machined from a cube of acrylic plastics and provision was made for the various metal inserts required in the operation of the valve. The inserts were identical with those used in valves which were being made for installation in the B-24's. When the model was fully assembled, the interior of the entire valve assembly was visible from every angle, and the part literally came to life as the interior parts moved with their normal action. In this way, explanation of the functional properties and the engineering fundamentals involved in the valve became instantly easier to understand.

Another part in which a plastic model has broken a teaching bottleneck is an engine-driven hydraulic pump (Fig. 5). Because of a difficult angle involved in the design of the part, it proved a bugaboo for both teachers and students. However, with the aid of a transparent model in which each piston and its relation to the operational cycle can be shown from

1—A transparent acrylic plastic model of the B-24's bomb door emergency valve, machined by regular methods, reveals every detail of this complex mechanism. 2—Of particular interest in this model of a complicated brake valve is the visibility of the spring which powers the operation of the valve. Since the internal parts all move, the compensating action of the valve can be readily explained. 3—This model of the hydraulic hand pump clearly reveals the cylinder and plunger-type piston. 4—This automatic seal coupling model shows the ball check valve that seats and seals the line against leakage when it is disconnected. 5—Each piston in this engine-driven hydraulic pump model is clearly visible. 6—This plastic model of the fuel selector valve illustrates the action of the poppet valves at the two inlet ports

any angle, the proper functioning of the assembly is easily understood.

In a third acrylic plastic assembly the complicated mechanism of a hydraulic hand pump (Fig. 3) was made clear after students saw the operation of the model cylinder and plunger-like piston. The mysteries of a ball check valve (Fig. 4) were no longer a mystery when students could examine its operation and observe the relative position of the functional parts at any stage in the operational cycle.

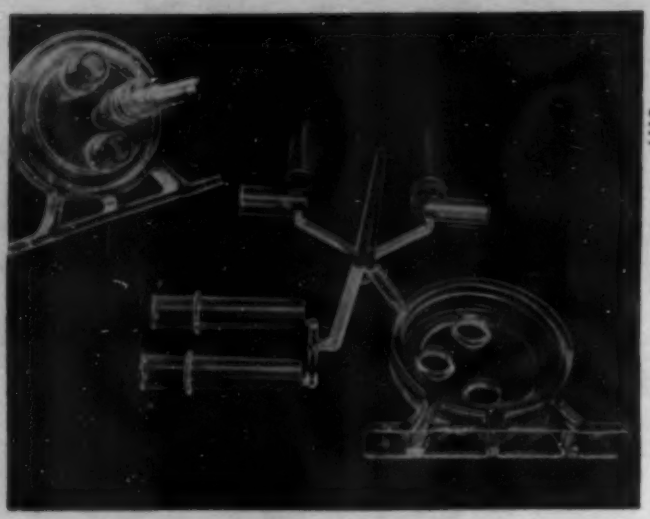
The most interesting model, however, is that of a bomb door emergency valve on a B-24 (Fig. 1). This is a complicated cube-shaped assembly literally filled with rods, valves, synchronized cylinders and pistons which must function with absolute precision. By the use of a model it is possible for instructors to show each stage in the emergency operation of the valve and to impress upon their students the necessity for the proper and certain functioning of each component part of the mechanism.

Though emphasis so far has been on the use of acrylic plastics as an aid in instruction, the possibilities of their use in engineering design appear impressive. Already occasions have arisen where an engineering principle has been emphasized with new and striking force as the result of the construction of a transparent model. Engineers, with the aid of plastic models of new appliances, can watch the functioning of every part of the contemplated machine and project changes in preliminary design and practice. In this way they are able to avoid the common pitfalls which the conventional procedures frequently entail.

Because of the stress of wartime production, very little thought has been given to the use of acrylic plastic models in trade exhibits but the advantage of such applications is readily apparent. The strength and rigidity of transparent plastic models, coupled with the comparative ease with which they may be machined, recommend them especially to a manufacturer who desires to show a prospective customer the complete picture of his particular product in action.

At the present time the plastics department of the Ford Motor Co. is manufacturing models exclusively for use in the Ford Airplane School, the Willow Run Air Base School and for the Army Air Forces at Wright Field. Until the needs of these agencies have been filled it is not expected that the department will be able to undertake additional assignments. The prospects for the future, however, offer many interesting possibilities not only in the field of aircraft but also in many other industries where complex machinery is employed.

Credits—Material: Plexiglas. Models by Ford Motor Co.



WHAT HAPPENS TO THE ACID IN THE BATTERIES of combat aircraft when the airplane banks, loops or flies upside down? In the case of the Douglas A-20, a battery drain arrangement is employed to prevent this vital and corrosive fluid from running out and damaging the ship. This unit consists of a polystyrene cover that screws onto any Mason jar. It is attached to the battery by means of flexible tubing which feeds into the Mason jar through 3 short polystyrene tubes. These thermoplastic tubes, which are cast on the same gate, are cemented into holes molded into the transparent plastic cover.

The battery drain cover and the tubular inserts are molded in a 5-cavity die on a 9-oz. capacity injection molding machine. The material is injected at a temperature of 400° F. with a 400-ton clamping pressure on the platens. Ram pressure is 2000 p.s.i., providing a pressure on the material of 60,000 pounds. The die is provided with automatic core-pulls that are interchangeable.

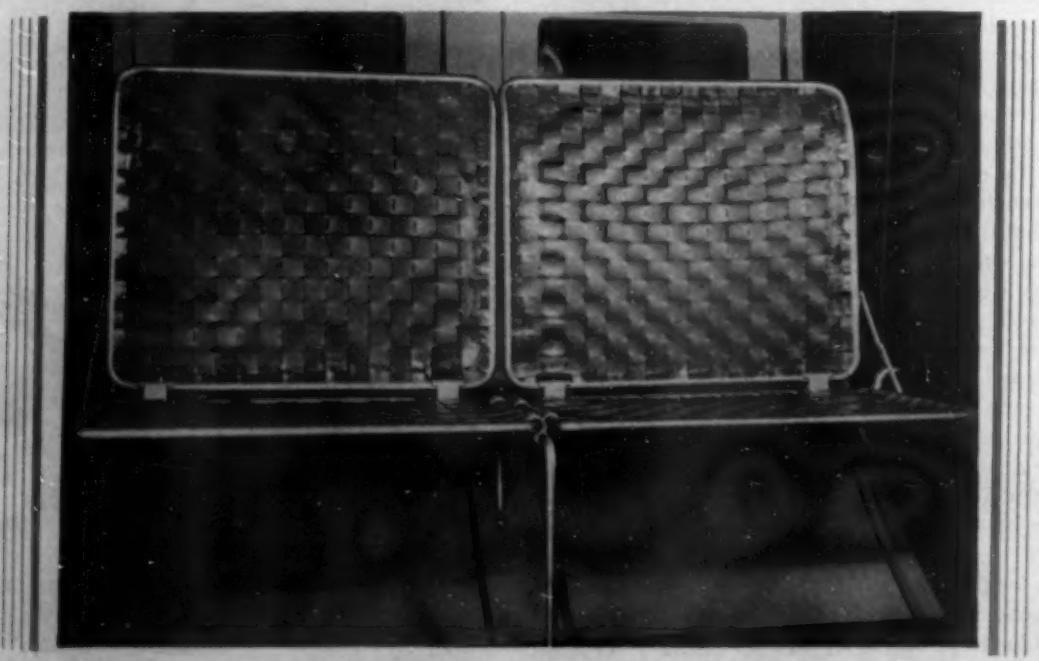
A bracket by which the battery drain unit can be firmly attached to the interior of the plane is molded as an integral part of the cover. Two different types of covers are cast in the one die—the difference being taken care of by a change in the die insert. So successful has been the operation of these battery drain attachments on the A-20, that the apparatus is now included in the construction of all airplanes which are daily coming from the assembly line of this airplane manufacturer.

Credits—Material: Lustron and Bakelite polystyrene. Molded by Na-Mac Products Corp. for Douglas Aircraft Corp.

THE RAILROAD TRAIN, THE AUTOMOBILE AND now the airplane have all gone through the same cycle of development. In the years following the introduction of each of these types of transportation, safe and efficient operation was the principal concern of both designers and engineers. With safety taken for granted, passenger comfort and convenience became the prime consideration. And so it is that today luxurious comfort is the problem facing the industrial designer who is concerned with the planning of the details which will be incorporated in the passenger airplane of the postwar world.

An example of the plastic fittings that may be found in postwar airplanes is this 2-seat collapsible bench covered with a webbing of polyvinyl chloride acetate. The unit is built into a full-sized "mock-up" of the first postwar airliner planned by Consolidated Vultee Aircraft Corp. The passenger entrance in this proposed plane is situated in the exact center of the fuselage. When the two sliding entrance doors are closed, these plastic webbed chairs fold down from a recessed panel and fit into the doorway area. By this space-conserving design, additional seating capacity is provided which may be used for extra passengers or for lounging purposes. In this "mock-up," plastics are also suggested for use in a full length mirror in the ladies' lounge, for interesting effects in lighting fixtures, for window shades and for many other decorative uses.

Credits—Chair seat of Vinylite. Designed by Henry Dreyfuss for Consolidated Vultee Aircraft Corp.



PRODUCTS*

ASSAULT TROOPS LANDING ON ENEMY SHORES must be in readiness for immediate action. Landings in Italy and Tarawa demonstrated that firearms must be kept dry in open invasion boats as well as during the initial rush through shoal waters to the beach. To meet this need the Army has adopted extremely flexible waterproof gun bags, or gun boots. These bags are so designed that after a gun is placed within, they can be closed tightly by a simple knot. Upon closing, enough air is trapped inside the boot so that the bag and gun will float for an indefinite period if dropped into the sea. The vinyl chloride vinyl acetate copolymer film from which these bags are made is so flexible that men armed with pistols, rifles or machine guns can manipulate the trigger and begin firing immediately, without pausing to remove the protective wrapper.

The first bag materials were made by calendering and extrusion processes. However, the Quartermaster Corps wanted a material of lighter gage with greater flexibility and strength than could be produced by these methods. A query as to the possibility of producing the desired film on casting equipment instigated intensive research work which resulted in the approval of a pilot production sample after 6 weeks. Three months later it was in commercial production.

At the present time this special vinyl film, olive drab in color, is 0.0025 in. thick. The cast film is said to exhibit considerably better physical properties than its counterparts made by the extrusion and calendering processes. By the casting method this film can be produced as thin as 0.001 inch.

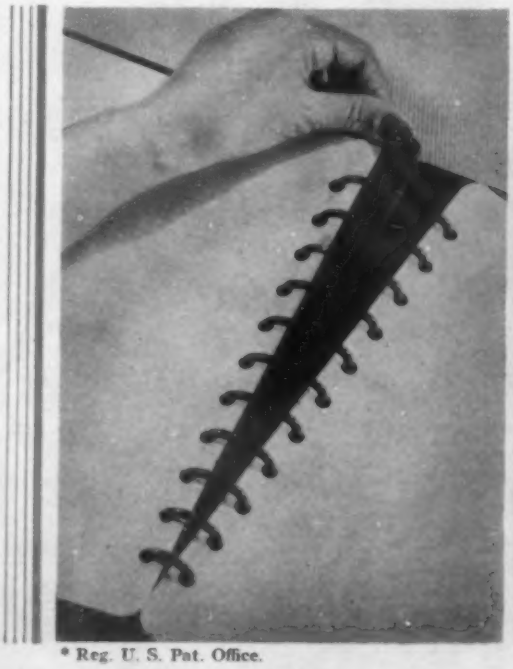
Credits—Material: Lumarith V.N. Bags fabricated by Shellmar Products Co.

APPEARANCE AND EASE OF OPERATION. IN A loose-leaf binder it has usually been necessary to sacrifice one of these two important elements to achieve the other. In the past, if the need was for a loose-leaf folder in which the sheets always lay flat, a ring binder was the ideal choice. On the other hand, a post-type binder was indicated if less bulk and greater assurance that the leaves would not tear were desired.

The newly developed "Fleetring" plastic binder, consisting of a series of 11 ring-posts, would seem to combine the advantages of both ring and post-type construction and, in addition, make the changing of sheets a simple procedure. The plastic binder has two other advantages. It is available in a wide range of colors so that maximum eye appeal can be given a catalog through the use of a binder of a color that harmonizes with the cover. This new binder also has the advantage of being approximately one-third lighter in weight than the conventional metal types. With mailing costs bulking large in the catalog budgets of most companies, this factor is of considerable importance.

The binder is molded in two sections of cellulose acetate butyrate or methyl methacrylate. In the final assembly the two sections are riveted together at one end so that the binder can be swung open in a scissors movement when sheets are to be added or removed. A lever at the opposite end of the binder enables the unit to be opened with the upward pressure of the thumb and closed with equal ease.

Credits—Material: Tenite II and Lucite. Molded by Kampa Manufacturing Co. for the Heinn Co.



* Reg. U. S. Pat. Office.

PHOTO, COURTESY U. S. ARMY SIGNAL CORPS.

Low-tension insulating wire

by H. E. ALLEN*

The exigencies of war have brought a need for electrical insulation materials of greater flexibility at low temperatures. Here we find cellulose acetate butyrate sheeting employed in a new capacity to meet the rigid performance standards of Army specifications. Cut to tape widths as illustrated below, this material is used in such field instruments as the walkie-talkie shown at the left

EVEN before Pearl Harbor it had become evident that if our planes were to fly and our instruments function at altitudes of from 35 to 40 thousand feet, new materials would be needed for use as electrical insulation. While cellulose acetate has good dielectric properties, this older plastic is subject to definite limitations with respect to flexibility at extremely low temperatures and, as a result, is less desirable for use as wire insulation. However, the mixed esters of acetic and butyric acids are less subject to this limitation and hence offered excellent possibilities of meeting the conditions imposed by the new performance standards made necessary by modern warfare.

Even before it became necessary to rewrite Army, Navy and Air Corps specifications to provide for increased performance requirements, a large materials manufacturer had begun the manufacture of cellulose acetate butyrate sheeting in various thicknesses ranging from 0.0005 to 0.0016 inch. Experiments were undertaken to adapt this film to the production of low-tension aircraft wire and of radio hook-up and communication wire needed in tremendous quantities by the Armed Forces. Because of the cooperation of various manufacturers, wires were produced almost immediately that passed and even far exceeded the new specifications. Two or more servings of 0.0016-in. cellulose acetate butyrate were used as the primary insulation. Equipment for applying thin tapes to wires presented no particular problem since a surplus of this machinery seemed to exist in plants of various manufacturers. Machines designed for both pads and universal cops have been pressed into service in an effort to speed much needed wire to our many battle fronts.

The handling characteristics of the cellulose acetate butyrate sheeting were considerably improved through the application, by a midwest converter, of an opaque, heat-sealing coating of modified vinyl acetate. This same company in addition to perfecting improved slitting techniques, developed a method of laminating two 0.0016 in. thicknesses of the sheeting for use on larger cables. The modified vinyl acetate coating serves a twofold purpose—as a visual control of the first serving on the conductor and as a means of facilitating the sealing of the laps. Heat and solvent action act to accomplish this end. When the two coated sides of the tapes are applied one to the other, a tight seal can be effected at around 200° F. The pressure exerted by the braid or other secondary insulation while the wire is passing through the drying ovens is usually sufficient. Wire, particularly in the smaller gages, which is treated in this manner will pass the life cycle tests of both the ANJC-48-a, Aircraft wire specification, and Signal Corps Spec. 71-1677 now referred to as C75/465.

Cellulose acetate butyrate, being a thermoplastic, has no definite melting point but will soften rapidly at temperatures above 350° F. However, recent (*Please turn to page 170*)

* Industrial sales manager, Dobeckmun Co.

PLASTICS*
Engineering Section
F. B. STANLEY, Editor

Polyfibre—a new approach to molding

by W. C. GOGGIN† and R. R. BRADSHAW‡

THE trend of engineering thinking has been toward lighter structures—a goal which the war has shown to be desirable. Naturally, the tendency has been to use the familiar light structural materials—magnesium, aluminum, stainless steel and plastics—to accomplish this purpose. Although in certain cases where extreme lightness is desired—even plastic materials have left something to be desired—to date the engineer has had no alternative but to reconcile his design work with the lowest specific gravity that could be obtained from well-known plastic materials. However, the advent of Polyfibre[1] provides the engineer with a new design material with which to reach unusually low densities. Now, strong articles with specific gravities as low as 0.4 are possible.

While heat and pressure are the agents through which plastic materials are generally fabricated, the speed and the scope of fabrication are largely dependent upon two factors. First, the ability of any material to receive heat is a function of the surface area presented to that heat. Therefore, since it is desired to obtain a material which responds quickly to heat, it becomes necessary to prepare one which presents a large surface area per unit weight. One of the most practical ways in which this can be achieved is through the use of compacted extremely fine fibers. Pressure is the second consideration that limits the scope and speed with which plastic fabrication can be accomplished. Shrinkage is one method by which a material might be made to exert pressure on itself, and highly elongated or oriented fibers often exhibit this tendency. It was through this method of approach that the concept of very fine, highly oriented fibers as a molding material originated.

The form of Polyfibre discussed in this article is based on polystyrene and is a fiber ranging in size up to 5 microns in diameter. A comparison of this extremely fine fiber size with some of the more familiar natural fibers is shown in Fig. 1. The high degree of orientation existing in the fiber is relieved when the fiber is heated and shrinkage results.

At present, the product is supplied in its simplest form as a bat of parallel fibers running crosswise of the bat. The bat, approximately 14 in. in width and 10 ft. in length, has, in this form, an apparent specific gravity of about 0.05. In its present form, this bat may not be entirely convenient for all types of fabrication. As supplied, the bat contains a small percentage of solvent whose effect on both the fabrication and finished products will be discussed later.

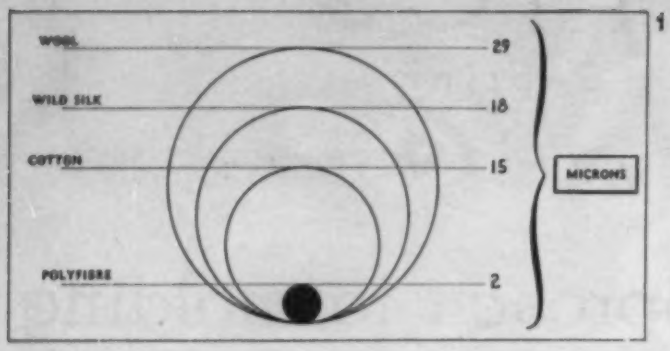
While Polyfibre was designed principally with a view to further heat fabrication, it has in itself some interesting properties as a fiber. Inasmuch as the bat is composed of extremely fine fibers, it contains many minute air spaces, and for this reason is a good low-temperature thermal insulation. Figure 3 presents data on thermal conductivity values as plotted against density and also serves for comparison of the conductivity of this material with that of corkboard.

The concepts of good thermal insulation and of rapid heat absorption appear to be incompatible. Actually, this is not the case. Used as a thermal insulation the fibers of the bat are not tightly packed. However, as a molding bat, the fibers are tightly packed and the air is evacuated. Tight packing and large fiber surface combine to permit rapid heat absorption and relatively short molding cycles. In addition to excellent thermal insulating value at low temperatures, this unusual material appears to be one of the best sound insulating mediums. Theoretically, this is to be expected inasmuch as the slightly compacted fiber bat contains a multitude of interconnected air paths, and the relatively long paths offer the best possible channels in which sound waves may dissipate their energy.

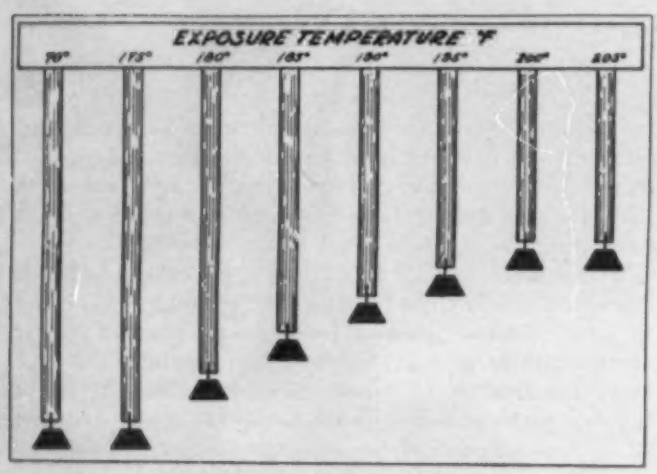
Polystyrene in itself is difficult to wet—a property that is also inherent in the polystyrene-type of Polyfibre. As a result, it is possible to consider the material as a replacement for kapok in applications requiring buoyancy. These applications include floats, life vests and various types of emergency-rescue equipment.

There are two general methods of molding to which Polyfibre is applicable. The first and most commonly known method is that of compression or press platen molding. Bulk polystyrene has been molded by the compression method in the past, particularly when sizes larger than those conveniently made by injection molding are desired. However, the use of bulk polystyrene has been limited by the fact that it is a thermoplastic and consequently needs long compression cycles. Polyfibre, because of its large surface area, not only responds more rapidly to heat but requires a lower molding temperature. In consequence, the time required to heat or to cool the mold is reduced and rapid compression molding cycles are possible. Because of the shrinkage inherent in the material, the pressure needed to mold the fiber product to full density may also be reduced. For this reason it is possible to build relatively cheap, light-weight molds whose cooling and heating channels are close to the working surface. Thus, the multiple objectives of reduced molding time, greater production rates, use of low-cost light-weight molds and lower molding pressures are simultaneously achieved, and the original concept of increased molding speed with fibrous raw material is substantiated. The procedures are designed to give a molding of full polystyrene density (1.05 g./cm.^{3}).

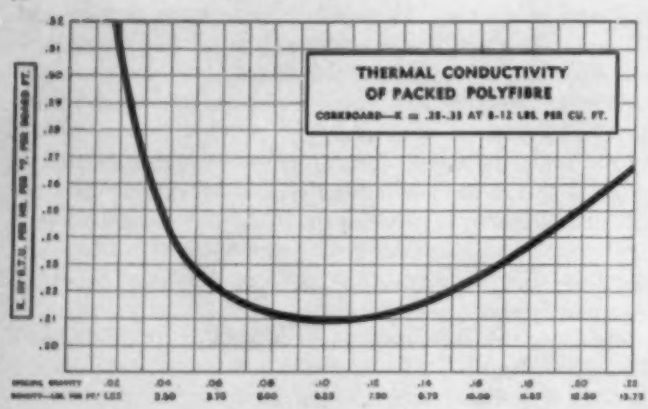
† Manager, Plastics Development Division, Dow Chemical Co.
‡ Molding engineer, Plastics Development Division, Dow Chemical Co.
[1] Manufactured by Dow Chemical Co.
* Reg. U. S. Patent Off.



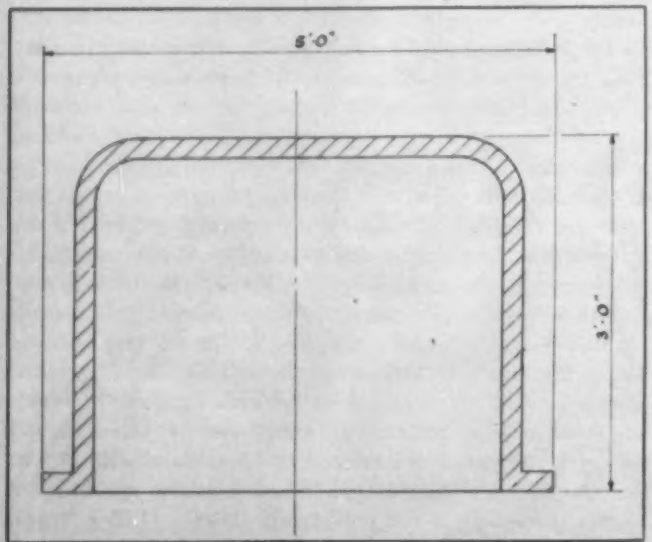
1



2



3



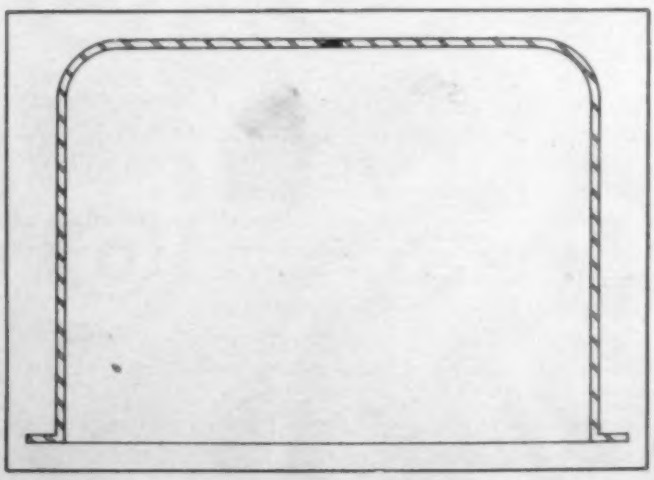
4

One of the most interesting properties resulting from the compression molding of Polyfibre is that of impact strength. While bulk polystyrene moldings have a relatively low impact strength, oriented polystyrene fiber has not only high tensile strength but high impact strength. Strangely enough, even though these moldings are carried to complete density, a large portion of the fiber's high impact strength is retained in the molding. Threefold increases in impact strength over that of bulk polystyrene moldings are not uncommon.

Until the advent of polystyrene fiber, the low-pressure bag molding of thermoplastic materials had never been considered a commercially feasible process. Polyfiber's rapid absorption of heat, based on its large surface area and its ability to shrink when heated, has made possible its commercial use in low-pressure bag molding fabrication. As a result, the scope of thermoplastic fabrication has been considerably extended. In the first place, large-size thermoplastic moldings can now be obtained with inexpensive equipment and low-cost molds without the use of high pressure. Secondly, complex contours impractical in compression molding become practical through the use of bag molding. The final and probably the most important contribution to thermoplastic fabrication, rests upon the fact that molding densities can be accurately controlled. Molded fiber densities ranging from 0.4 to 1.05 g./cm.^{3} are entirely feasible.

There are several basic types of bag molding processes that involve male or female molds with bags on either one or both sides of the die. All these methods may be more or less applicable to Polyfibre, and a description of one of them will reveal the details of procedure sufficiently to indicate how the material might be handled by the other processes. In the method chosen, thin female molds with good heat-conducting properties and a bag tailored to fit the molds both inside and out will be described.

1—A comparison of the average fiber diameter in microns. 2—The force exhibited by shrinkage of the fibers is shown by the distances through which the weights are lifted after the material is exposed to increasing temperatures. 3—This curve shows thermal conductivity values plotted against density, and serves for comparison of conductivity of this material with that of corkboard. 4—Cross section of the shape used to explain the molding method. 5—The thin metal die. 6—Tailored rubber molding bag. 7—Method of laying up the bats over the inflated bag to insure a uniform thickness in the molding



5

While molds for this process can be made by any convenient method, they should be of metal or some other good heat-conducting medium. To provide uniform heat transfer, the molds should be of uniform thickness throughout. Several molds which have been found successful are: 1) sand-cast magnesium molds, 2) zinc or other metal sprayed on appropriate wooden or plastic patterns, and 3) spun metal, for symmetrical sections. Molds need not be designed for heavy loads since pressures are relatively light and, in most cases, balanced. The greatest success has been obtained with the female-type mold. Molds should be designed for relatively low shrinkage rates. The temperatures involved are not high, and probably most of the shrinkage can be directly attributed to thermal contraction on cooling. Experimental work has shown that a shrinkage in the order of 0.002 in./in. may be expected. Since the molded plastic will reproduce the surface of the mold, the latter should be designed to give whatever degree of finish is desired. The rubber bag for use with this mold should, if possible, be tailored. It is felt that a vacuum bag designed for some elongation on evacuation will give better finishes on the molding surface opposite the metal surface or inside the molding.

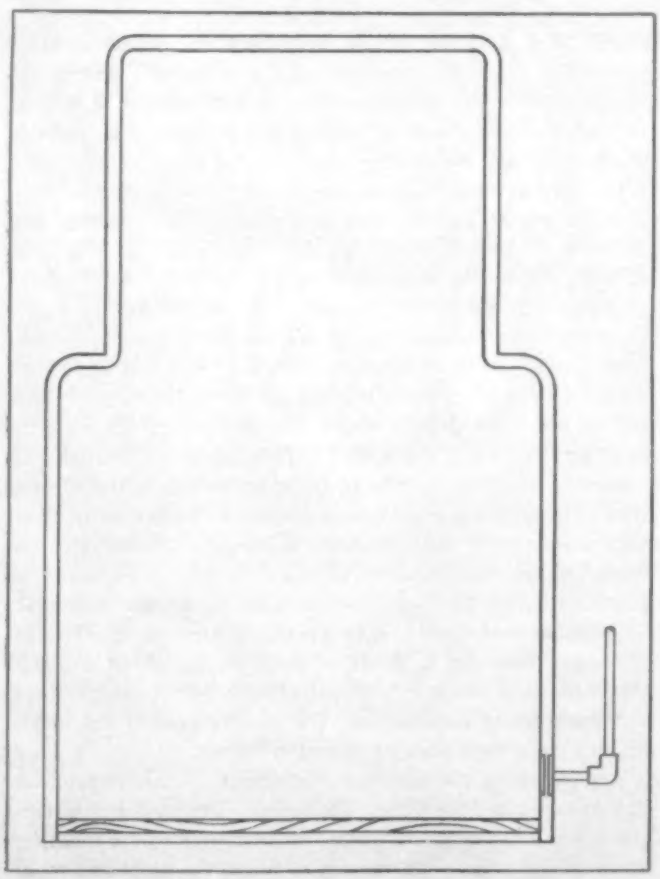
In order to clarify the molding method, a rather large shape some 5 ft. in over-all diameter and 3 ft. in depth, has been selected. The vertical cross section is regular (Fig. 4) but in its horizontal cross section it consists of circles of various sizes. It might be considered part of an aircraft fairing, a section of a refrigerator unit, a section of a loud speaker, or any one of a number of large complex shapes. It is a shape that could be handled conveniently by bag molding methods. A suitable die which might well be made of thin spun metal is shown in Fig. 5. The remainder of the molding assembly consists of the tailored rubber bag (Fig. 6).

The first important part of the molding procedure is the proper lay-up of the bats to insure a uniform thickness in the finished molding. Several methods can be used successfully, one of which would involve the use of a pure rubber (non-cloth) tailored bag (Fig. 7). While the natural size of the tailored portion of the bag is several inches under that of the mold, when inflated the bag can elongate until it reaches the mold size. To assist in the bat lay-up, the bag can be inflated or perhaps placed over a form and used as a mandrel around which the bats can be wrapped and draped.

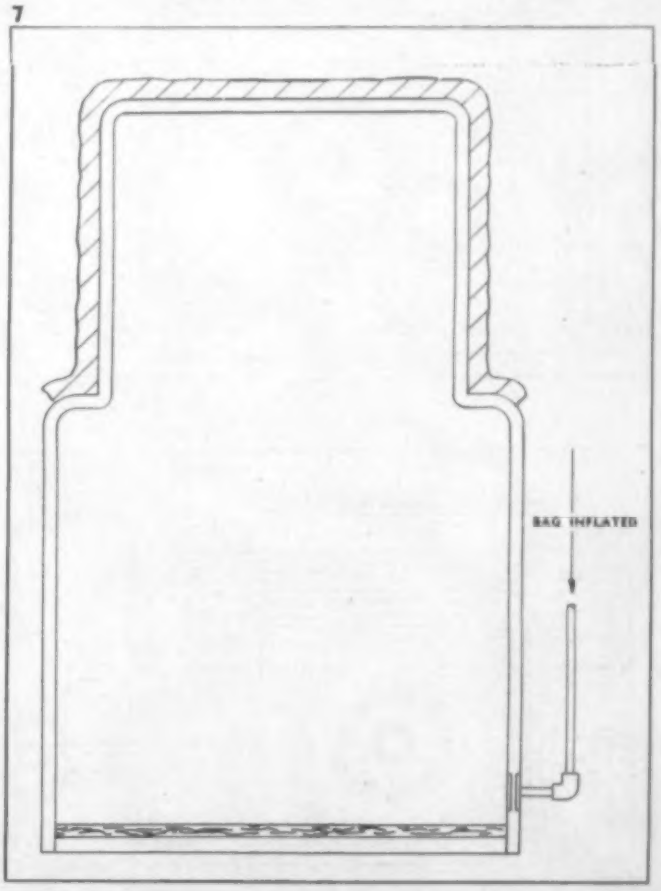
The amount of material to lay on the mandrel may be determined by calculating from the molding's volume and density the appropriate weight of the finished piece. A sufficient amount of bat material to finish the completed molding is then weighed out. It is suggested that bats be draped in such a way that they cross at the end of the bag and drape down along the sides of the mandrel. Of course, this would normally give an increased thickness at the small end of the molding but compensation can be made by wrapping additional bats around the inflated rubber mandrel, laying them up in such a way as to prevent non-uniform overlapping and the resulting heavy molded sections. The rubber mandrel, as the bats are laid on it, can be gradually deflated as necessary so that the outside dimensions of the laid-up bats become small enough to enter the die proper. The laid-up bat is then ready to receive the die. Figure 9 shows the bag, the bat and the mold in place.

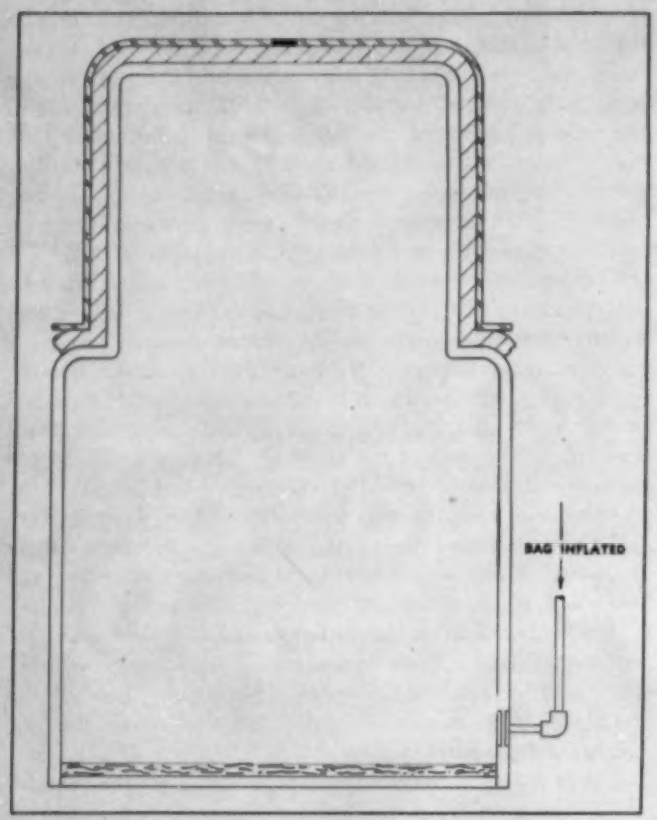
The next step in the molding process is to turn the cylindrical portion or skirt of the tailored bag inside out, carrying it over the outer portion of the metal mold. The opening of the rubber bag is then closed by clamps, and the bag is evacuated by an appropriate vacuum system. This step of the operation is depicted in Fig. 10. On application of the vacuum the fiber itself, due to external atmospheric pressure, is compressed to comform with the inside walls of the

6

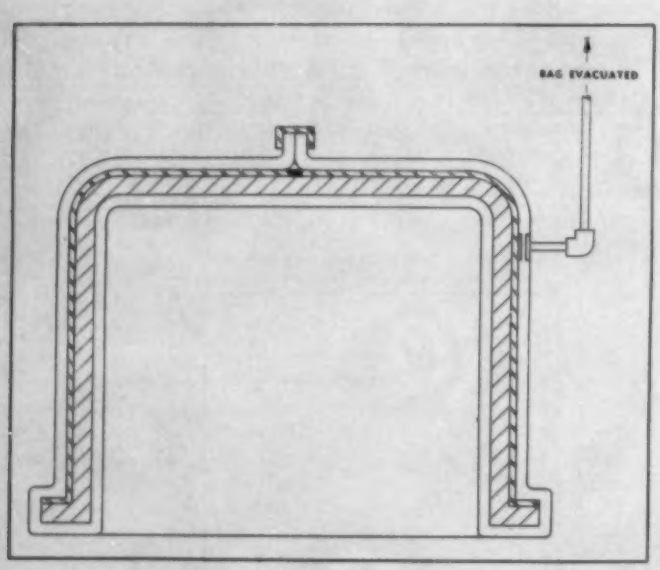


7

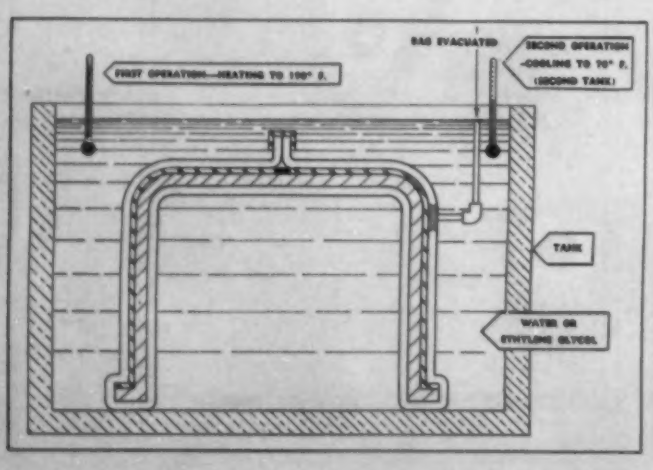




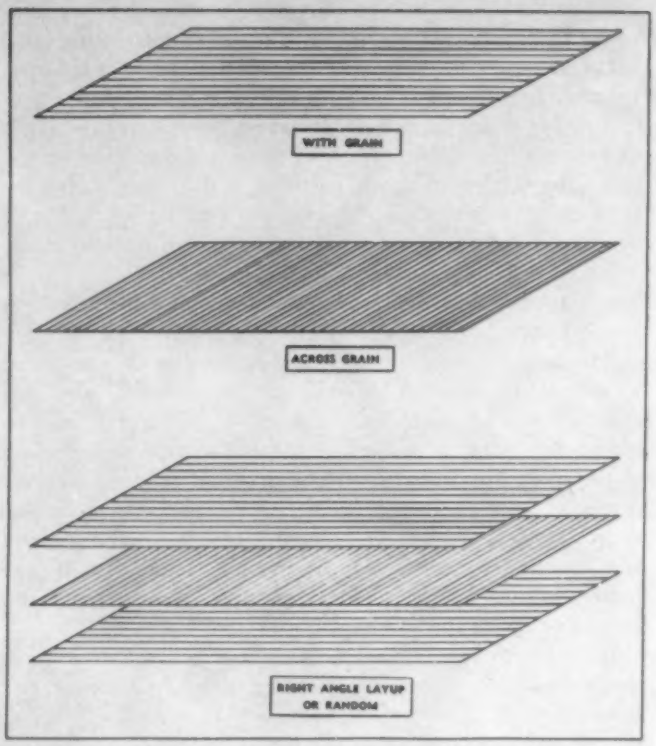
9



10



11



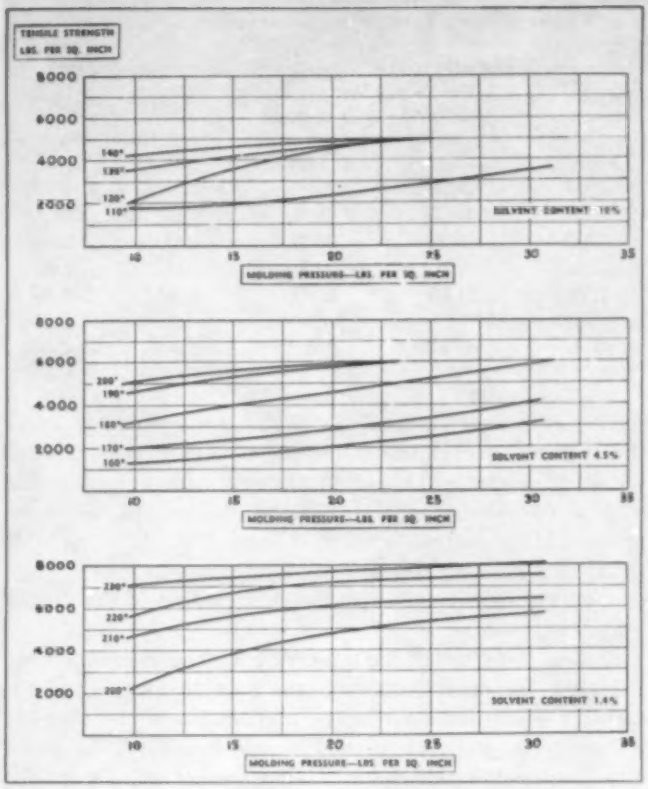
8

8—This drawing indicates three methods of lay-up. 9—Here the bag, the bat and the mold are in place. 10—In the next step in the molding process the rubber bag is folded back, sealed and evacuated by an appropriate vacuum system. 11—Water baths are employed to maintain the desired temperatures during molding. Cooling operation and heating cycle are combined in this unit

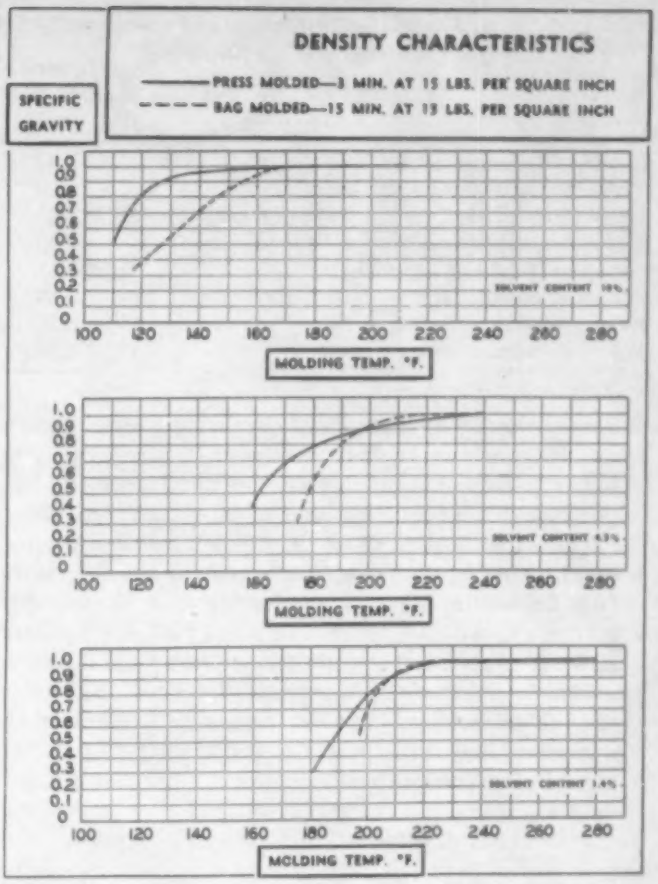
mold. The assembly is now ready for the actual molding portion of the cycle. Because of the material's prompt response to heat, high temperatures are not required, and temperatures such as may be maintained accurately in suitable water baths are frequently used. In the example used here (Fig. 11), a water bath is employed. The mold assembly could, however, equally well be placed in an autoclave or a suitably controlled oven. In the example used here, the product in this instance would be molded to a density of approximately 0.8 or 0.9 g./cm.^{3} in 15 min. at 200° F.

At the completion of this period the entire mold assembly is removed from the hot water bath and chilled in a tank filled with cold water. The advantage of the water-bath chilling is that the time during which the molding is subjected to heat may be closely controlled. This can be contrasted with autoclave molding in which, in order to reach the desired temperature, a large volume of air has to be heated or filled with steam after the autoclave is closed. Conversely, the same volume of air must be cooled or the steam must be removed before the parts can be taken from the autoclave. This longer heating and cooling period makes the close control of temperature very difficult, whereas the use of hot and cold water baths, whenever practical, eliminates this uncertainty. For purposes of convenience, the cooling operation and the heating cycle have been combined in Fig. 11.

After chilling, the vacuum is broken, the clamp is removed and the bag is lifted from the form. The molding is then taken from the cavity proper. In instances where moldings have straight sides, the vacuum between the mold and mold-

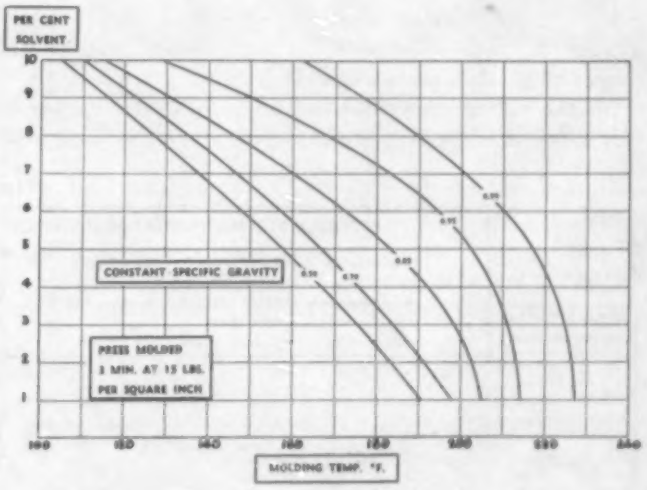


12


DENSITY CHARACTERISTICS
PRESS MOLDED—3 MIN. AT 15 LBS. PER SQUARE INCH
BAG MOLDED—15 MIN. AT 13 LBS. PER SQUARE INCH
SPECIFIC GRAVITY
MOLDING TEMP. °F.

13

12—*These curves show the tensile strength characteristics of 3 grades of the fiber, press molded 3 min. with grain.* **13**—*Relationship between molding temperature and specific gravity.* **14**—*Constant density curves.* **15**—*Relationship of tensile strength to specific gravity for the 3 grades of the material, press molded 3 min. at 15 p.s.i.*

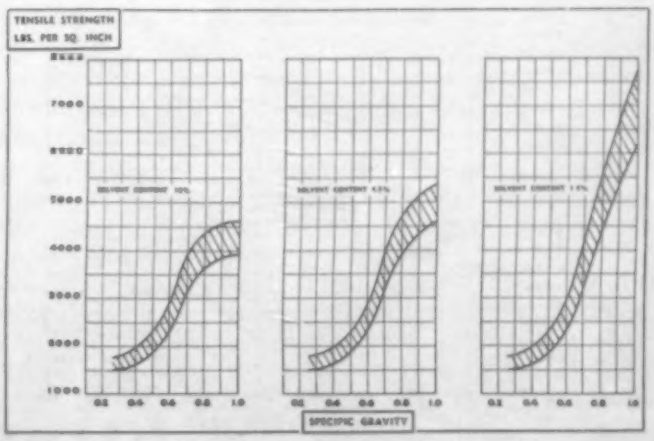


14

ing may be difficult to break and some trouble with removal may be encountered. The function of the small opening or hole at the closed end of the mold now becomes apparent. An air blast is directed to this small opening to relieve the vacuum and to exert pressure—moving the piece away from the cavity. This device has often greatly simplified molding removal.

The molding cycle that has just been described is subject to many variations. At least four distinct variables pertain to the molding cycle through which the density and, consequently, the ultimate properties of the molded part may be controlled. The major variables are time, temperature, molding pressure and solvent content of the fiber. The effect of each of these varjables on the ultimate properties reveals the flexibility of the process and particularly the range of properties that can be obtained.

As previously mentioned, the Polyfibre bats consist of parallel fibers running crosswise of the bat. Due to the orientation of the fiber, the greatest strength in a molding is developed in a direction parallel to the fibers. Thus, if a uniform strength in all directions is desired, it is important that the bats be laid up in alternate crossed layers. From the standpoint of test results on moldings, two possibilities are apparent: 1) the use of alternate layers at 90° to each other, which will give average values, or 2) the use of layers with the grain parallel, which will give maximum results with the grain and minimum results across the grain. The latter method was chosen to increase the scope and utility of the results. (*Please turn to next page*)



15

TABLE I.—COMPARISON OF PROPERTIES OF POLYFIBRE AT VARIOUS DENSITIES WITH POLYSTYRENE

	Polystyrene, *standard molding grade*	Polyfibre (*4.5 percent solvent content*), *random fiber layup*				
		D = 0.60	*D = 0.70*	*D = 0.80*	*D = 0.90*	*D = 1.0*
Specific volume, cu. in./lb.	26	46	39	34	30	28
Tensile strength, lbs./sq. in. (average)	7000	2000	2300	2600	3200	3900
Impact strength, in.-lb. ($^1/_2$ x $^1/_8$-in. unnotched)	1–2	...	13.5	9.5	6.0	3.0
Flexural strength (maximum)	14,000	2200	3600	6000	9800	15,000
Hardness (Rockwell superficial)	90–93	...	...	15	49	80
Dielectric constant ($10^6\sim$)	2.55	1.72	1.85	1.99	2.20	2.40
Heat distortion	175	160	160	160	160	160
Water absorption, percent	< 0.05	0.1	< 0.1	< 0.1	< 0.1	< 0.1

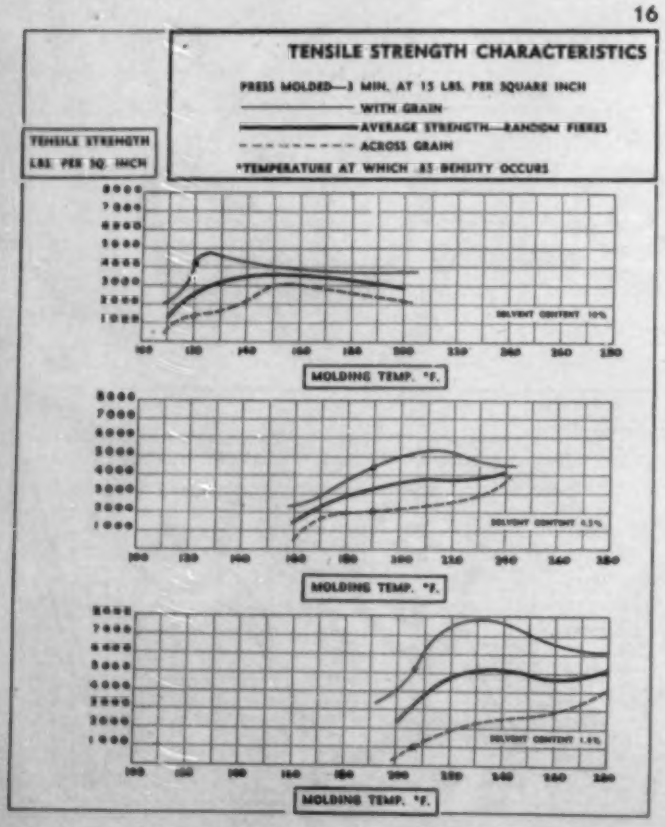
Wherever the lay-up methods affect the test results which follow, the charts are marked "with grain," "across grain" or "random"—the last mentioned meaning 90° alternate lay-up.

With the desire for light-weight moldings in mind, one of the first relationships in which the designer will be interested is that between molding temperature and the specific gravity of the finished molding, a relationship that is presented graphically in Fig. 13. It will be noted that at a constant pressure of 15 p.s.i. and over the temperature range depicted, the solvent content of the fiber greatly influences the density of the finished molding. In order to observe this effect, molding pressures and times were held constant at 15 p.s.i. for 3 min. during pressure molding, and 15 p.s.i. for 15 min. during bag molding. The major variables now become solvent content, molding temperature and specific gravity. Figure 13 shows these relationships. It is noted that specific gravity of moldings increases with solvent content and with temperature. The limit, of course, is 1.05—the specific gravity of polystyrene. It is also noted that as the solvent content decreases, the molding temperature must be increased to obtain a certain specific gravity.

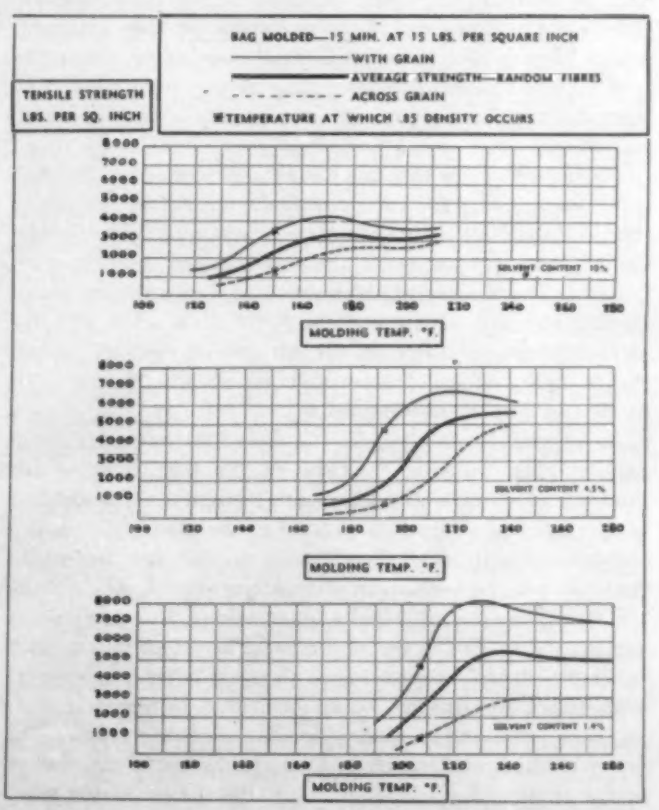
On the curves shown for bag molded samples, temperature required to reach a certain specific gravity at a specified solvent content is higher than that for press molding. Since this is due to the relatively low rate of heat transfer through the walls of the bag, the data are only relative and should not be considered absolute. From the curves based on press moldings and replotted as shown in Fig. 14, it is possible to select a molding temperature for the production of parts of a desired density when the solvent content of the fiber is a known quantity.

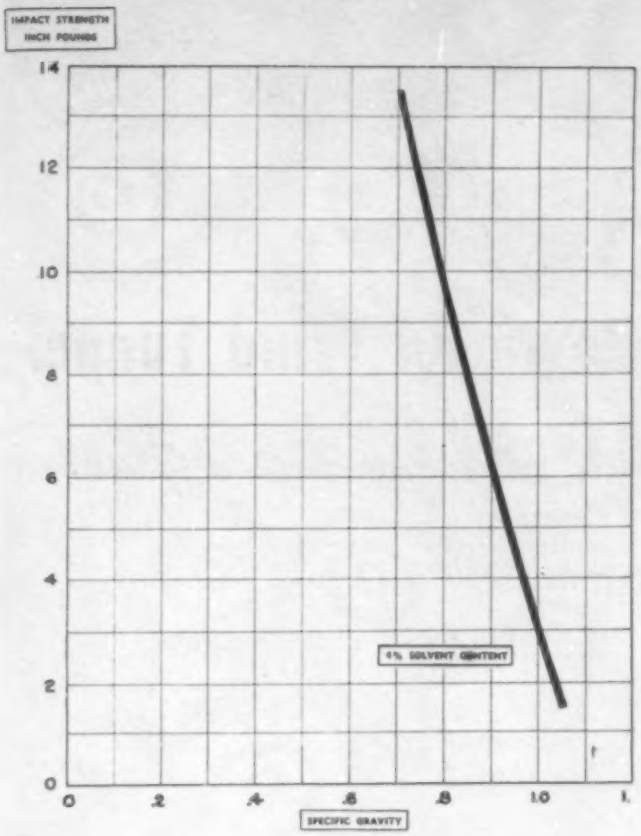
As is to be expected, the strength characteristics of molded Polyfibre are dependent upon the specific gravity, or the molding conditions used in the preparation of the samples. Figure 16 is designed to show tensile characteristics under a range of molding conditions. Here solvent content and the direction of the oriented fibers play important roles. Three curves are shown for each material. Lower tensile strength values were obtained on specimens on which the strength was determined "across grain." The upper or higher strength curve represents values on the same panels determined "with grain," and the center or intermediate group represents the value which might be expected with a panel produced from fibers laid up at "random." For multi-directional strength, it is recommended that the bats be laid up so that the fiber direction in one ply is at right angles to

16

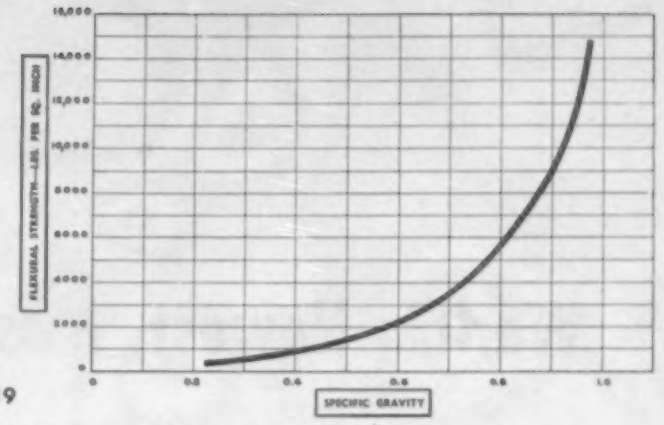

TENSILE STRENGTH CHARACTERISTICS
PRESS MOLDED—3 MIN. AT 15 LBS. PER SQUARE INCH
WITH GRAIN
AVERAGE STRENGTH—RANDOM FIBRES
ACROSS GRAIN
*TEMPERATURE AT WHICH .85 DENSITY OCCURS
TENSILE STRENGTH LBS. PER SQ. INCH
MOLDING TEMP. °F.

17

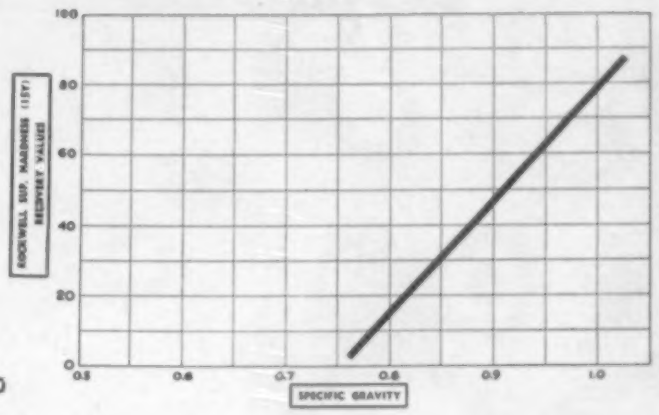

BAG MOLDED—15 MIN. AT 15 LBS. PER SQUARE INCH
WITH GRAIN
AVERAGE STRENGTH—RANDOM FIBRES
ACROSS GRAIN
*TEMPERATURE AT WHICH .85 DENSITY OCCURS
TENSILE STRENGTH LBS. PER SQ. INCH
MOLDING TEMP. °F.



18



19



20

16—Tensile characteristics of the material under a range of molding conditions. **17**—*This chart summarizes the tensile strength characteristics of the bag-molded fibers.* **18**—*Relation of impact strength and density.* **19**—*Range of flexural strength, press molded with grain—15 p.s.i., 3 minutes.* **20**—*Relation of hardness to specific gravity*

the direction of the fiber in each of its neighboring plies.

A definite optimum in molding temperatures for each of the three grades of material exists with respect to the "with grain" strength. It should be noted that while maximum "with grain" strength increases substantially with lower solvent content, the average or "random" fiber tensile strength at a density of 0.85 g./cm.^{3} increases very little.

In much the same way, Fig. 17 summarizes the tensile strength characteristics of bag molded Polyfibre. In general, the same conclusions may be drawn. The shift in optimum molding temperatures for the 10 percent solvent material from 125° F. for press-molded specimens to 170° F. for the bag-molded samples is due to limited heat conduction through the bag. If a longer molding time is employed, the strength of bag-molded panels becomes more like that of panels prepared by press molding at the same temperatures. The curves then approach identical positions. At higher temperatures, where the effects of low thermal conductivity of the rubber bag are minimized, the time cycles are adequate and the optimum temperatures for press and bag moldings, as well as the temperatures required to mold to 0.85 density, are practically identical.

Relatively few readings were taken to determine elongation of the specimen during the tensile testing. Calculated values indicate that elongation ranges from $2^1/_2$ to $5^1/_2$ percent. These values should be considered as indicative rather than actual.

Figure 12 shows composite curves that demonstrate the variation at constant temperature in the tensile strength of three grades of Polyfibre with variation in molding pressure. In each case, the pressure employed is critical in the lower temperature range. However, a temperature exists with each material above which molding pressure makes little difference within the limits of 10 to 30 p.s.i. Further investigation indicates that in the case of highly oriented fiber of somewhat larger size, it is desirable to mold at pressures as high as 100 p.s.i. Under these conditions molding strengths are improved because less fiber orientation loss is permitted and, in consequence, more strength-giving orientation is retained in the molding.

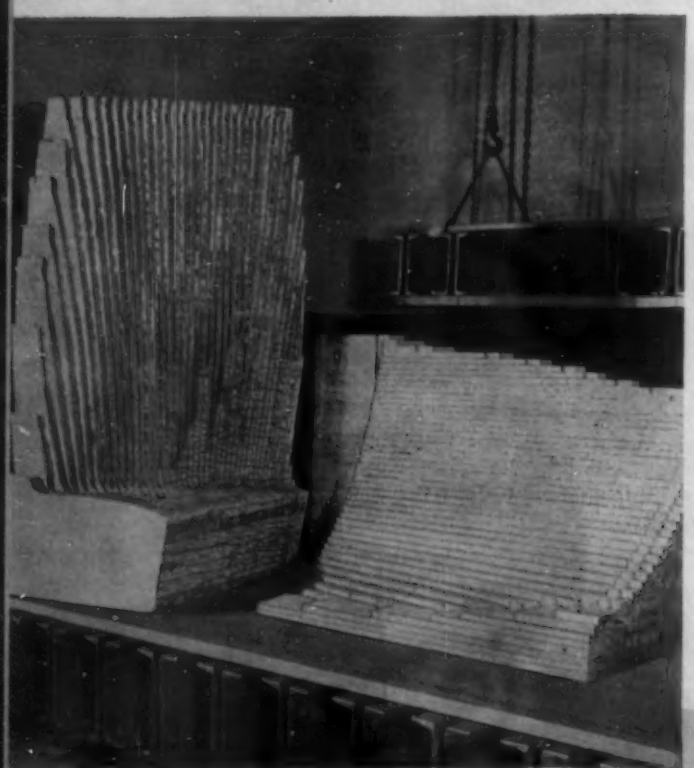
The relationship of tensile strength to specific gravity for the same three materials with their different solvent content is shown in Fig. 15. In this instance, the specimens were tested only with the grain. The solvent content appears to have little effect on tensile strength at densities below 0.7 g./cm.^{3} Above this point, higher strengths are obtained with lower solvent content. As can be seen, a separate band exists for each of the three materials tested.

The impact strength of Polyfibre is one of its outstanding characteristics. Retention of fiber orientation in the finished molding undoubtedly accounts for the impact strength improvements as compared with moldings made from bulk polystyrene. Even at full density (1.05), the fiber moldings usually show strength increases which indicate that some orientation still remains. With a decrease in density, the impact strength increases rapidly (Fig. 18). Below 0.70 density the samples usually bend over under impact and the results are high but unreliable. It will be noted that at 0.70 density, the impact strength of a 4 percent solvent material is some 9 times that of polystyrene. The flexural strength of the fiber when press molded "with grain" can best be shown by a curve plotted against spe- (*Please turn to page 164*)

World's Newest, Most Powerful Wind Tunnel

. . . uses fan blades made with Plaskon Resin Glue!

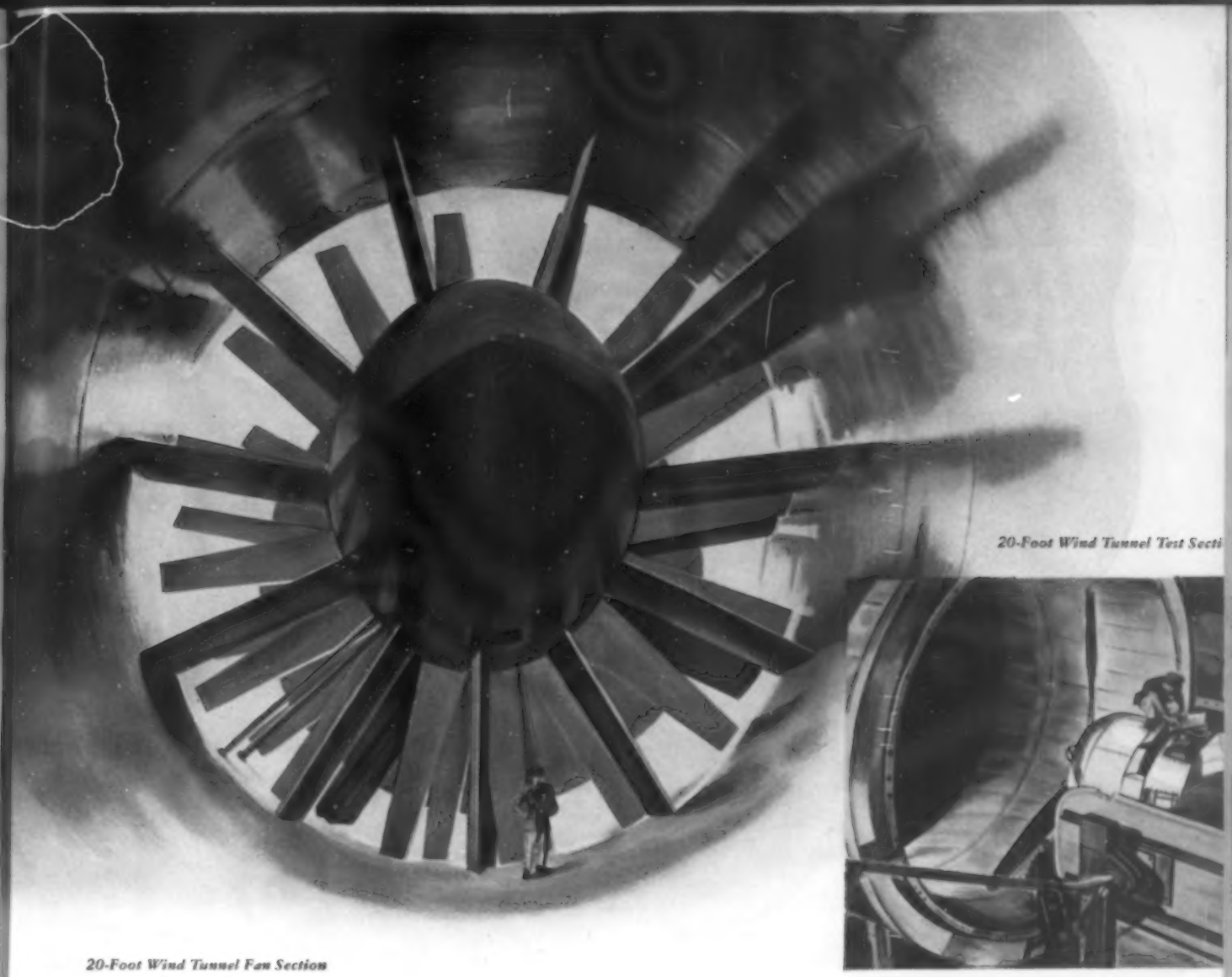
Close-up view of one of the Plaskon-glued fan blades in its rough block form, as it comes from the pattern at right. The many layers of spruce *permanently* bonded with Plaskon Resin Glue are clearly shown.



Over 600 miles per hour, at 67° below zero! This is the terrific wind velocity attained in one of the several air tunnels built by the Army Air Forces at Materiel Command Headquarters, Wright Field, Ohio.

Ranging up to 45 feet in diameter, these air tunnels prove American plane and engine designs *on the ground,* to assure greater superiority for our pilots *in the air.*

Fan blades in the newest tunnel are made of *spruce wood laminated with Plaskon Resin Glue,* for no other materials offered the neces-



20-Foot Wind Tunnel Test Secti

20-Foot Wind Tunnel Fan Section

sary assurance of quick, safe construction to meet the exceptional needs of blade and wind speeds. During the operation of this particular fan, the total centrifugal force tending to tear a blade loose from the hub approaches 250,000 pounds, and 150 tons of air per minute pass through the fan!

Under brutal, unprecedented tests such as this, Plaskon Resin Glue daily is proving its greatest feature . . . the *permanence* and *indestructibility* of the bond it can produce in the gluing of wood and many other types of porous materials. This unbreakable bond remains strong and permanent under all conditions of moisture, heat and cold. Mold cannot destroy its holding power. Neither water, gasoline, oil nor any common solvents can lessen the powerful grip it maintains between glued-up materials.

Plaskon Resin Glue is being used widely for many wartime jobs, in the permanent assembly and molding of a wide variety of products of wood, paper, fabric, and other materials. It offers many opportunities for new postwar product developments.

PLASKON

TRADE MARK REGISTERED

★ RESIN GLUE ★

PLASKON DIVISION

LIBBEY · OWENS · FORD GLASS COMPANY, 2121 SYLVAN AVENUE, TOLEDO 6, OHIO • Canadian Agent: Canadian Industries, Ltd., Montreal, P. Q.

Injection mold design—Part II

by ISLYN THOMAS†

In the first section of this article on injection mold design which appeared on pages 103–5 of the June issue of MODERN PLASTICS, *a detailed list was presented of the facts that a designer must know concerning the part to be molded before he can start the mold design. Detailed information was also given concerning the design of the mold parts and the various types of runners.*

THERE are two main schools of thought regarding the size and type of gates that are necessary to control the flow of material into the cavities. A basic difference of opinion exists with respect to the size of gate that will properly control the motion of the material while it is in its semi-fluid or fluid state.

The motion of the material can be classified as either a laminar or turbulent flow (Fig. 14). The laminar or streamlined flow—generally produced by large gates—moves in parallel elements and is a desirable motion for molded items that require a minimum of stresses, air bubbles, shrinks, weld marks, etc. The turbulent flow is generally brought about by a small gate which turns the flow of material into a chaos of swirling eddies and vortices. This type of flow is desirable in some molded articles in spite of the fact that it has a tendency to increase stresses, air bubbles, shrink marks, etc.

The temperature of the material, the pressure on the material and the speed of the injection plunger all have an influence upon the motion of the material as it enters the cavities. The cost necessary to remove the excess material from the molded article is another factor to consider in determining the type and size of gate. At this point a definite understanding between customer, sales engineer and designer is essential inasmuch as gating and finishing costs of some items are more than the combined cost of the material and the molding.

Many different gates are in use, and in the following paragraphs as many types as possible will be classified.

Standard gate—This type of gate (Fig. 18) is used more often than any other since it is adaptable to most injection molded articles. The prime purpose of this gate is to minimize the cost of finishing.

Ring gate—As can be seen in Fig. 15, the ring-type gate is best suited for hollow cylindrical pieces such as pencil barrels and pipe stems (Fig. 16). The material enters the cavity

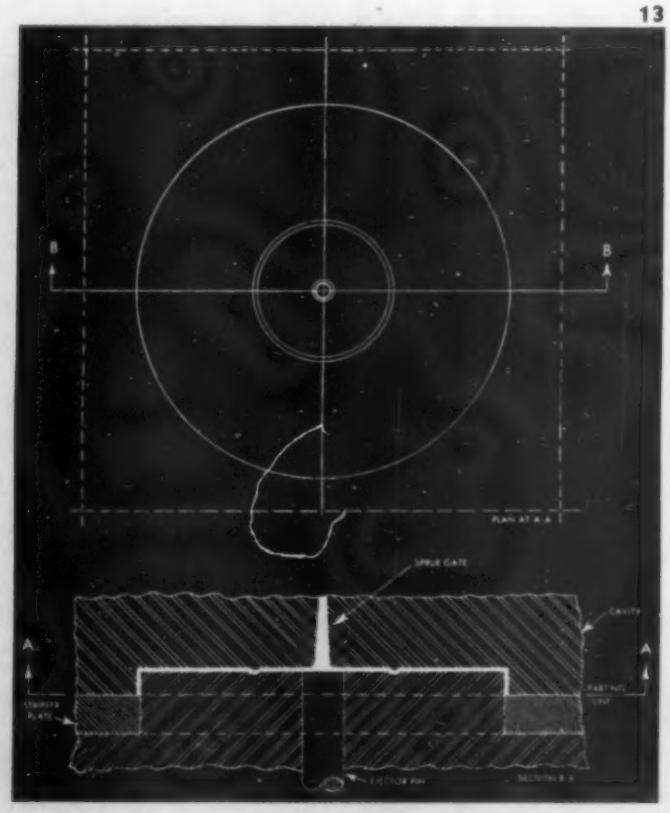
† General works manager, Ideal Plastics Corp. E.S.M.W.T. Instructor, Brooklyn Polytechnic Institute.

12—*A center or sprue gate is used for the molding in single-cavity molds of large pieces such as this film container.* **13**—*Use of a sprue gate allows an even flow of material into the cavity and helps eliminate the possibility of trapped air and weld marks.* **14**—*Motion of material as it flows into the cavities can be classified as either a laminar or turbulent flow.* **15**—*This blueprint of a ring-type gate indicates the manner in which the material enters the cavity around the core pins and flows down fairly evenly around the pins.* **16**—*A ring gate is best suited for hollow cylindrical pieces such as these pipe stems.* **17**—*A standard gate was used for the molding of these eye cups.* **18**—*The prime purpose of the standard gate, shown in this blueprint, is to minimize the cost of finishing*

PHOTO, COURTESY H. JAMISON

12

13



around the core pins and flows down fairly evenly around the pins. This material flow prevents the trapping of air and eliminates weld marks which would be prevalent if a standard-type gate were used. The removal of this ring from the molded piece usually increases the cost of the article since a machining operation is necessary.

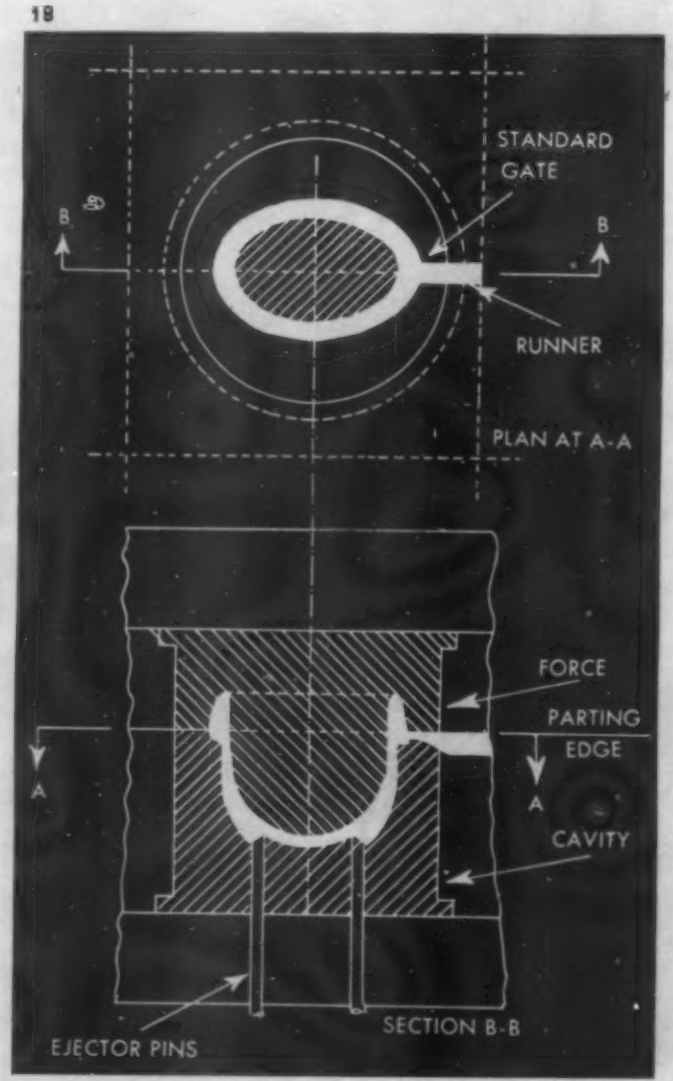
Sprue gate—In molding a large piece in a single-cavity mold as shown in Fig. 13, the only practical place for a gate is somewhere near the center of the article. An attempt to gate at the rim of such a large part would result in an unbalanced mold which, during a production run, might possibly cause the damaging of the mold and injection machine. Gating at the center, as shown, allows an even flow of material into the cavity and eliminates the possibility of trapped air and weld marks.

Fan gate—A fan-type gate (Fig. 24) is used for such articles as compacts, boxes, covers or other items having flat thin sections. The fan gate helps spread the material—improving the flow and minimizing the possibility of flow lines which would be objectionable on items such as those mentioned above.

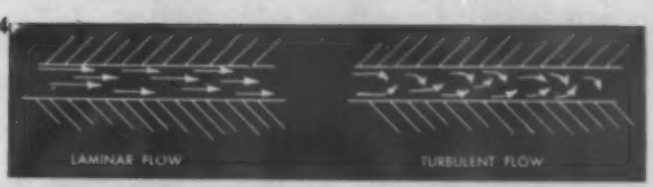
Disk gate—The disk gate is the opposite of the ring gate—the material flowing from around the center core to the periphery (Fig. 20). With this type of material flow, weld lines and trapped air are naturally eliminated if the mold is properly vented. Gates of this type are used most successfully on flat annular pieces such as bezels, etc.

Special gates—Special gates are sometimes necessary be-

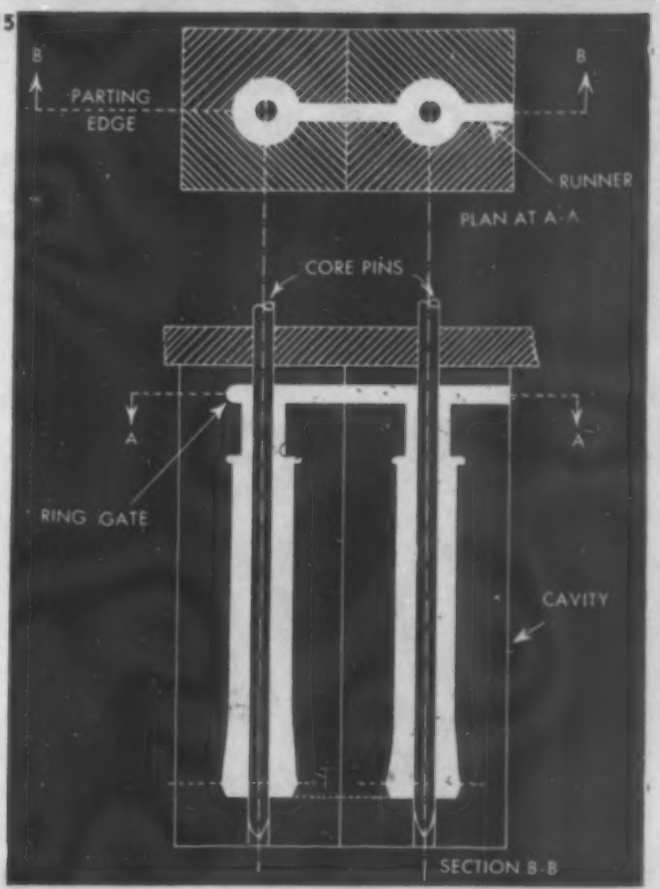
18



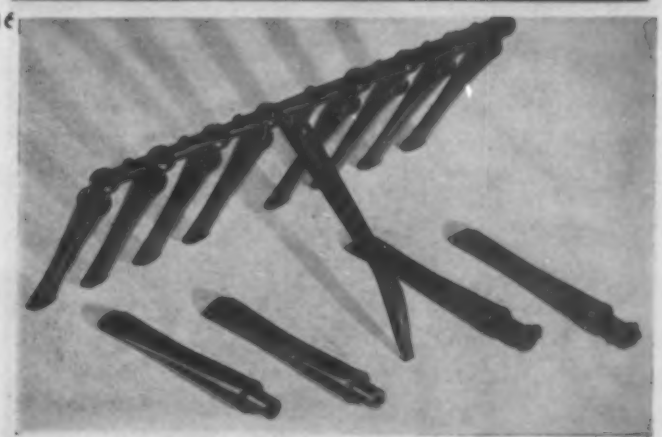
14



15

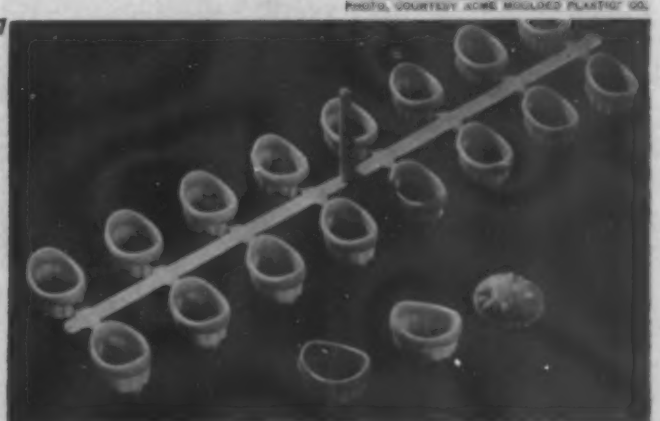


16



PHOTO, COURTESY ACME MOULDED PLASTIC CO.

17



cause of an unusual mold design (Fig. 21) or because of the absence of a suitable place on the article for an ordinary gate. With these gates, finishing operations are simplified since the width of the material to be cut is much narrower than with the standard-type gate. On a round cutting surface such as that shown in Fig. 22, the material width is even narrower. Figure 26 shows another special gate made necessary by an unusual mold design.

Design details

There are many other details which should be given careful thought before die drawings are submitted to the die shop. Some of these points are briefly outlined in the following paragraphs:

Cooling—Nearly all injection molds for thermoplastic materials are run comparatively cold. To do this, water channels are placed in the cavity plates or frames and, at times, directly in the core plug. While there is no set of rules governing the diameter of the water holes, general practice is to use $\frac{1}{4}$ to $\frac{3}{8}$ in. diameter holes for ordinary molds producing a shot weighing from 1 to 4 oz., and $\frac{1}{2}$ to $\frac{5}{8}$ in. diameter water channels for shots weighing over 4 ounces.

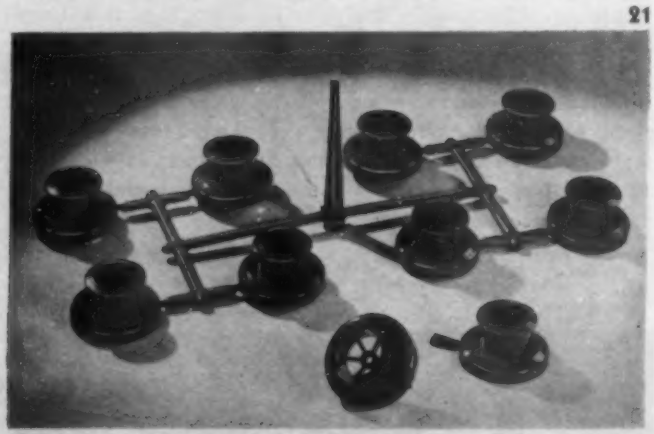
Water channels would be impractical for the cooling of core pins with diameters of $\frac{5}{8}$ in. or less. In such cases, air can be used to good advantage. This type of cooling is usually accomplished by drilling a hole in the core pin and attaching a small tube through which compressed air enters the larger drilled hole. This air is subsequently exhausted into the atmosphere (Fig. 27).

Venting—The problem of venting is deserving of more thought than is usually given it. Many well-designed and well-built molds have operated poorly because of incorrect and insufficient venting. Vents prevent burnt moldings, which are caused by heat derived from trapped and highly compressed air. In general, vents should be placed in those sections of the cavity where the final stages of flow take place since ordinarily it is at these points that the air is trapped.

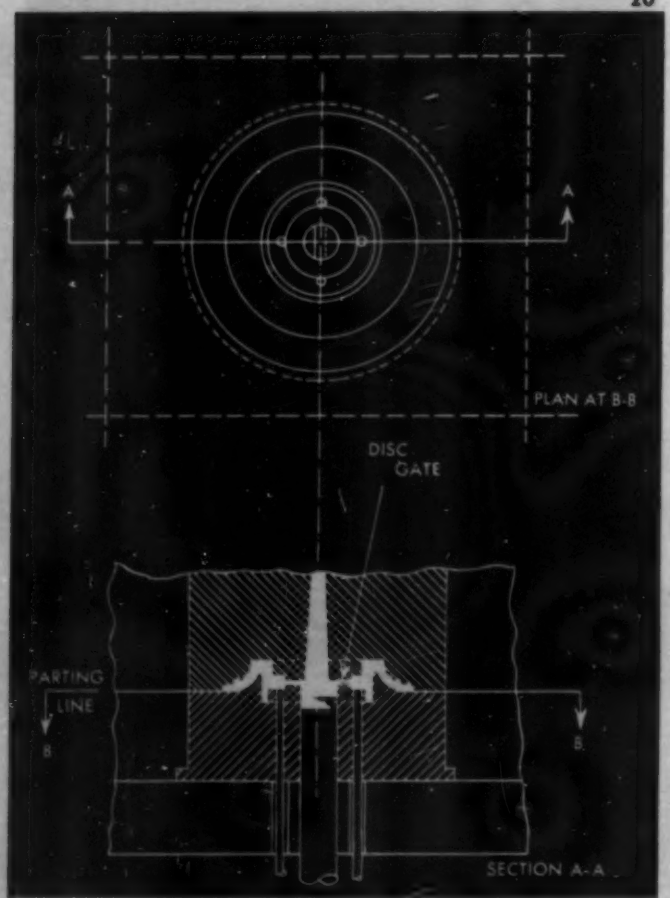
Sometimes it is also necessary to vent cavities at weld lines

19

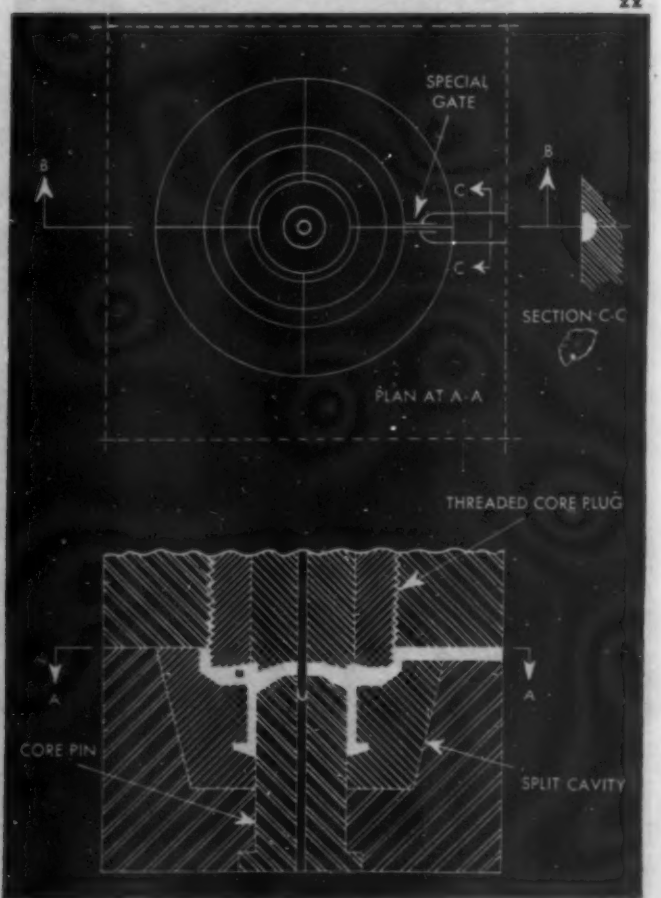
21



20



22



or junction points where two or more material streams meet and fuse into a solid mass. Release of trapped air in those cases will permit intimate contact between converging streams and result in the improved strength and appearance of the molded article.

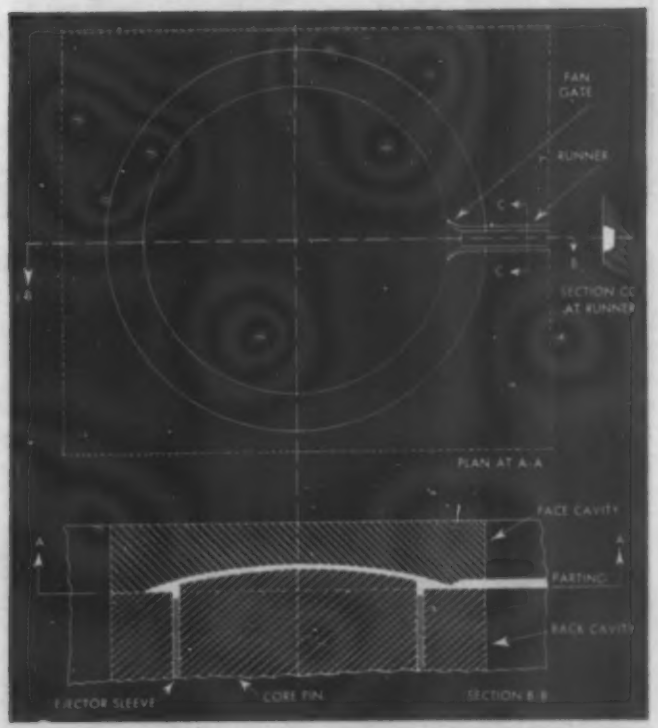
At welding points between converging streams of material that have travelled quite a distance, the surfaces of the plastic have cooled considerably. As a result, it is sometimes necessary to have a small reservoir or a well which draws off the coolest material—the material that is least likely to weld. This practice sets up a turbulent flow at the junction—a turbulence which has a tendency to interlock the two streams of material and increase the strength of the piece at the welding point. Frequently it is advantageous to incorporate an ejector pin under the well or reservoir. Such an arrangement can be seen in Fig. 29. The mold shown in this illustration is very difficult to make and to operate.

Draft or taper—Many molds have been designed without sufficient draft or taper. As a result, uniform production

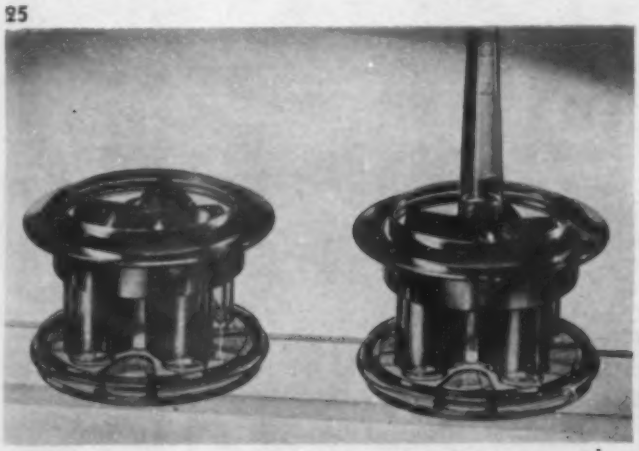
19—This is the type of article that is best adapted to the disk gate. 20—Blueprint of a disk gate. 21—A special gate was necessary for this part because of the absence of a suitable place on the article for an ordinary gate. 22—Blueprint of the gate used for the part shown in Fig. 21. 23—A fan-type gate is preferable for the molding of articles such as this compact. 24—Blueprint of fan gate. 25—The unusual design of this part made a special gate necessary. 26—Blueprint of gate used to mold parts shown in Fig. 25. 27—Cross section of air cooled core pin

23

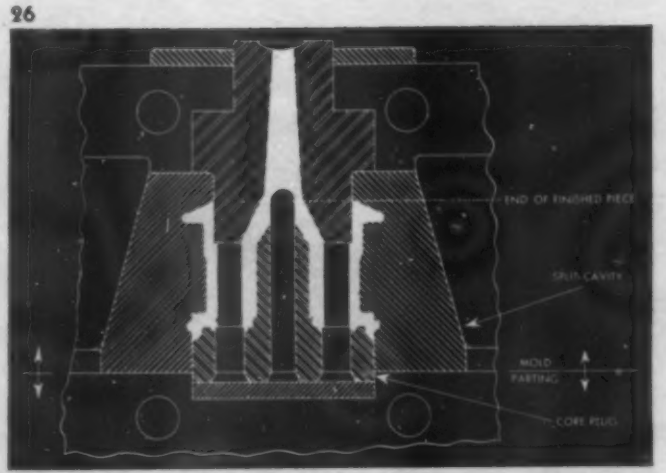
24



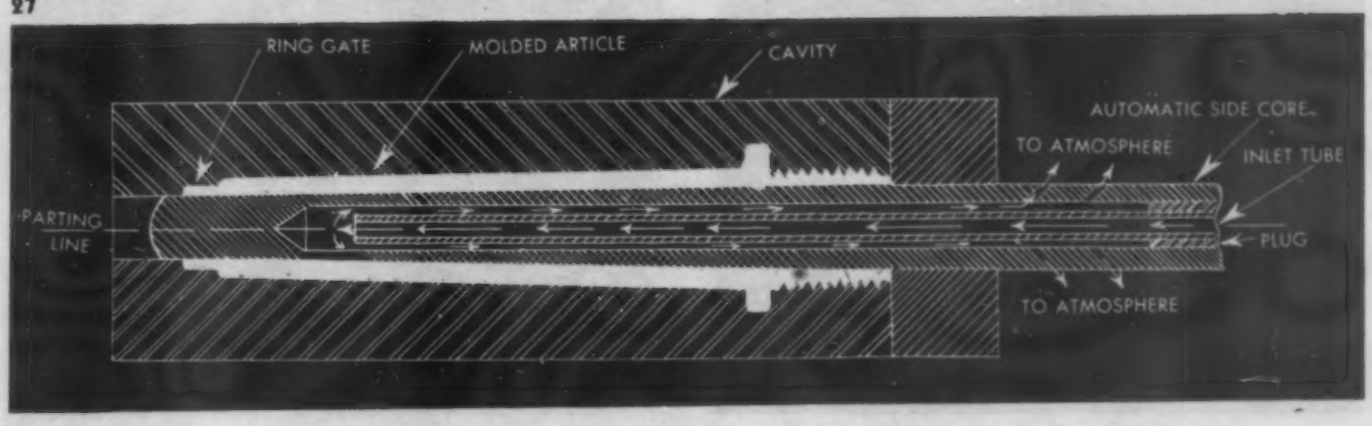
25



26



27



has not been possible because of the tendency of the molded articles to stick in the mold. If a minimum taper of at least 0.5° is used, most sticking can be avoided.

Sufficient taper and good molding procedure, minimize the need for dusting the mold with zinc stearate or any other special powder or mineral oils. It is preferable, if possible, to run the mold without powder or oil since powders and mineral oils tend to block or plug the vents and prevent the escape of trapped air.

Guide pins—Usually little thought is given to guide pins, or leader pins as they are sometimes called, since they are only simple hardened and ground pins that are used to align the mold halves. However, the pins should be longer than the longest core to ensure their entering the bushings before the core enters the cavity. Not only will this procedure protect the back cavity while the mold is being set in the machine, but it will help protect the mold when it is being repaired on the bench. The guide pins should be fastened to the moving half of the mold. This practice will permit the guide pins to move away and allow greater freedom to the operators.

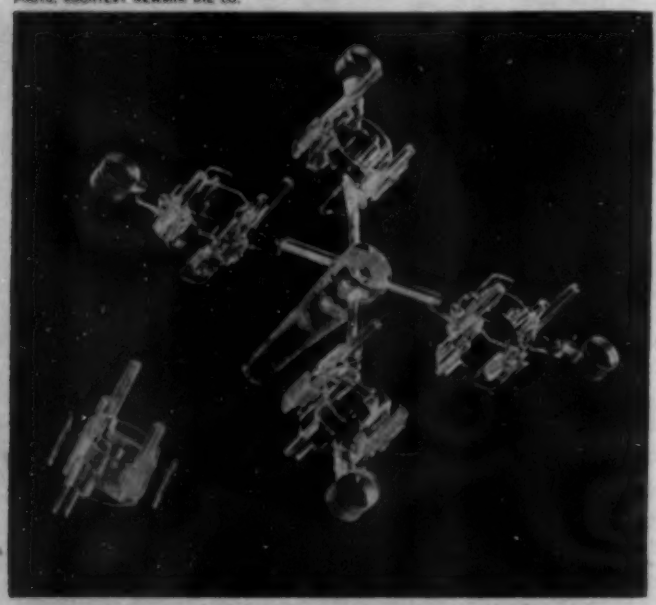
Mold supports—Supports on injection molds are deserving of considerable thought in view of the enormous pressures (up to 40,000 p.s.i.) which can be exerted by the material as it enters the mold. The absence of sufficient supports has been the major cause of molds that flash in the center. Sagging or collapsing of the center part of the mold could be minimized if supports were used in sufficient number (Fig. 30). Generally, these supports are round and placed where the mold has been cut away to make room for ejector mechanism.

After the mold has been completely designed, the designer should specify the correct nozzle size and not leave this decision to the machine set-up man. Too small a nozzle will increase the over-all cycle, set up strains and cause the trapping of gases due to fold-backs in material. Although there are no set rules for correct nozzle sizes, the general practice is to use as large a nozzle and sprue opening as is practical.

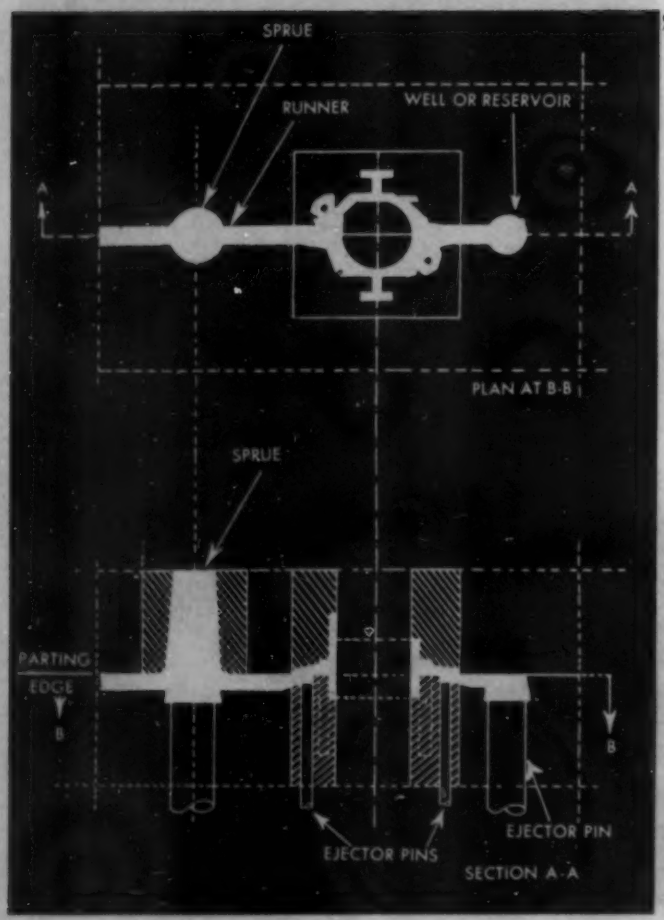
Finally, it is important to emphasize the fact that every mold is an individual problem. When completed, slight modifications in the mold may be necessary to make it suitable for the material which generally is ordered of a special flow and formulation.

PHOTO, COURTESY NEWARK DIE CO.

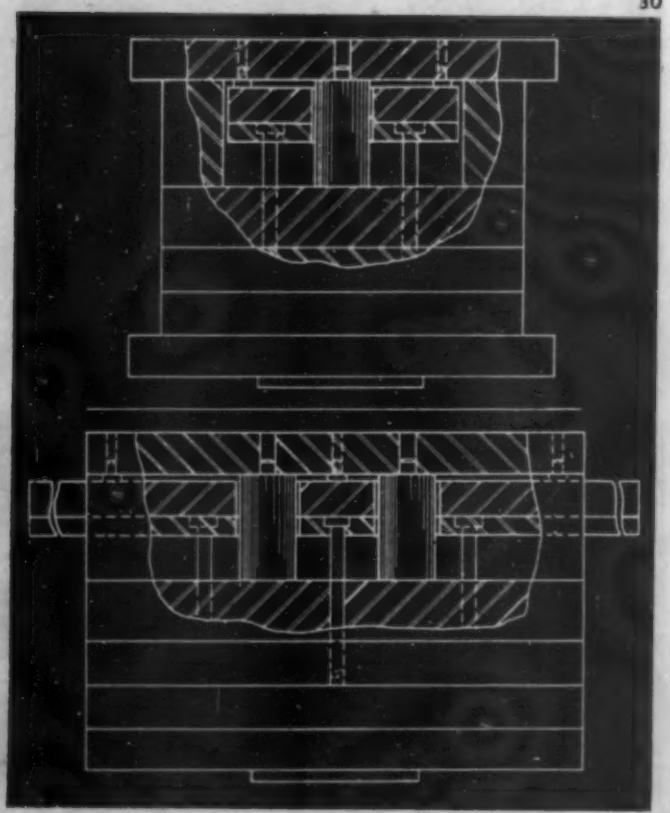
28



29



30



***28**—A sample of the sprue produced in the mold shown in Fig. 29.* ***29**—A reservoir has been built into this mold to trap the 'cold slug." The provision of an ejector pin under the reservoir or well has been found advantageous.* ***30**—Supports for injection molds minimize sagging or collapsing of the center part of the mold*

MEASUREMENTS of rainfall are taken in rain gages of shatterproof transparent Tenite by our armed forces. A copper replacement, the transparent Tenite has increased the degree of accuracy with which precipitation can be measured—vitally important in the planning and waging of war.

Outer tube and funnel of the rain gage are injection-molded, and the inner tube is continuously extruded. Calibrations are heat-branded on the inner tube. Because of the dimensional stability of Tenite, precise measurement in cubic centimeters of water is possible. Tenite withstands exposure to extremes of weather conditions without corroding and may be transported easily without danger of denting.

Other types of Tenite measuring devices which combine accuracy with ruggedness are manometers, graduates, and architects' and engineers' scales. For further information on Tenite and its many uses, write to TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENNESSEE.

TENITE REPRESENTATIVES . . . *New York*, 10 East 40th Street. *Buffalo*, 1508 Rand Building. *Chicago*, 1564 Builders' Building. *Dayton, Ohio*, 305 Third National Building. *Detroit*, 904-5 Stephenson Building. *Leominster, Mass.*, 39 Main Street. *Washington, D. C.*, 1125 Earle Building . . . *Pacific Coast:* Wilson & Geo. Meyer & Company—*San Francisco*, 333 Montgomery St., *Los Angeles*, 402 Architects Building, *Seattle*, 1020 4th Ave. S.

TENITE

AN EASTMAN PLASTIC

Rain gages are molded by Dillon-Beck Mfg. Co.

Life ON THE PLASTIC

EACH OF THESE HANDY, POCKET-SIZE BEETLE CONTAINERS holds a pair of M.S.A. Ear Defenders, designed for wear by industrial workers subjected to severe noise. Small and sturdy, light in weight, easy to keep clean, they are molded, complete with special Rathbun spring hinge, by the Rathbun Molding Corporation for the Mine Safety Appliances Company.

REMEMBER THIS ELECTRIC PENCIL SHARPENER with housing molded of brilliant BEETLE*? It is a typical prewar product with a postwar future because BEETLE's inherent qualities insure manufacturing success and customer satisfaction.

NEWSFRONT

LAMINATING WITH LAMINAC

1 **TESTING LAMINATED AIRCRAFT DE-ICER TANK.** In fabricating such large complex shapes, a fabric base is impregnated with LAMINAC* and wound around a cellophane-covered wooden mold. Wrapping tension, plus shrinkage during cure, provide pressure.

2 **LAMINAC LAMINATES** have a hard, smooth surface which can be machined to allow for inserts. LAMINAC has excellent dielectric strength, good dimensional stability, combines light weight with high structural strength.

3 **LAMINAC'S ABILITY TO ACT AS ITS OWN ADHESIVE** is one of its most valuable properties. Sections, such as the ends of this tank and laminated reinforcing ribs, are assembled by using the liquid resin as glue with short cure in the oven.

4 **FABRICATING OPERATIONS** such as cutting, sawing, or drilling, may be done at high speed. Physical and electrical properties of the laminates vary according to organic or inorganic fillers such as glass or fabric and resin content.

5 **FLAT SHEET LAMINATES** are extremely simple to fabricate and can be used for a wide variety of applications. Here parts for use in aircraft are being cut from LAMINAC impregnated sheets.

**Reg. U. S. Pat. Off.*

Photos: Courtesy U. S. Rubber Company

AMERICAN CYANAMID COMPANY · PLASTICS DIVISION
32 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID PLASTICS

BEETLE · MELMAC
URAC · MELURAC
LAMINAC

IT'S THE FILLING THAT MAKES THEM STRONG

In the case of the Army Medical Corps food service tray, shown here, the desired impact strength was acquired by compounding Claremont's chopped cotton cloth into the plastic formulation. The item, compression molded of chopped cotton fabric filled Melmac* is odorless, tasteless, has a hard scratch-resistant surface, is not affected by boiling water and food juices, can stand off the abuse of rough usage and constant handling. All Claremont fillers from flock to fabric are clean, uniform and perfectly graded. They process as well as they mix . . . They've got what it takes to build stronger plastic. Inquiries invited. *An American Cyanamid Plastic

CLAREMONT WASTE MANUFACTURING CO.

CLAREMONT, NEW HAMPSHIRE

Stiffness and brittleness of nonrigid vinyl chloride-acetate resin compounds*

by R. F. CLASH, JR., and R. M. BERG†

THE physical properties of elastomers, which largely determine their fields of application, are in general dependent on temperature to such an extent as to make it difficult to evaluate any given property over the useful temperature interval without exceeding the range and sensitivity of a single apparatus. Frequently this situation is resolved by setting up "spot" tests which establish arbitrary endpoint temperatures, deformations or load requirements based on the service conditions being investigated. Very little work has been reported wherein a given fundamental property of a plastic was evaluated over a wide temperature range. However, information of this type is desirable if these plastic materials are to be compounded and applied intelligently.

There are a number of methods which have been used to evaluate the change of mechanical properties of rubbers and rubber-like materials with temperature, e.g., simple[1-3] and cantilever[4-8] beam tests, stress-strain characteristics,[9-11] brittleness under high rates of deformation,[4,11-15] resilience studies,[16] Durometer hardness,[17] permanent set,[4,17,18] and special specimen assemblies and conditions which simulate complex service requirements.[19]

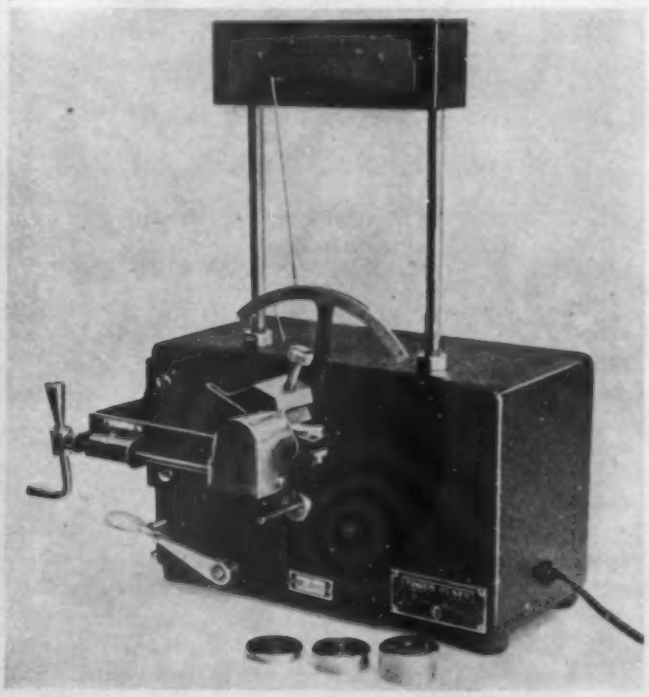
For our studies we have selected: (*a*) the Tentative Method of Test for Stiffness in Flexure of Nonrigid Plastics[20] (A.S.T.M. Designation: D 747); (*b*) Stiffness in Torsion (Bakelite Corp. Torsion Test); and (*c*) the Tentative Method of Test for Brittleness of Nonrigid Plastics[20] (A.S.T.M. Designation: D 746), as indices of the mechanical behavior

* Presented at the A.S.T.M. Symposium on Plastics held in Philadelphia, Pa., on Feb. 22–23, 1944, and published here through the courtesy of the American Society for Testing Materials.

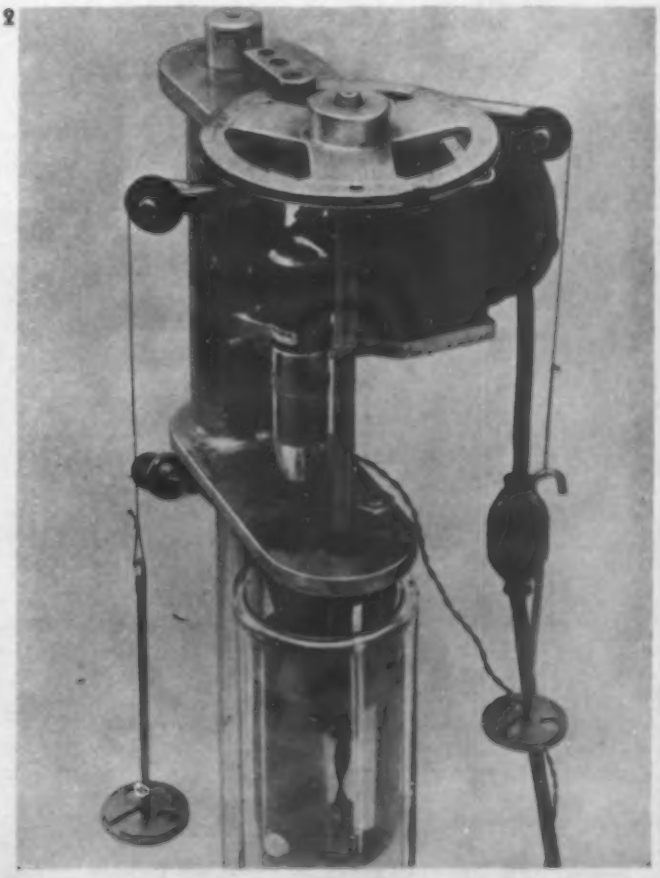
† Plastics Div., Carbide and Carbon Chemicals Corp.

1—Choice of methods for determining stiffness or apparent modulus of elasticity of nonrigid plastics is based on convenience considerations. Here is one model of the Olsen stiffness tester. 2—Close-up of the torsion apparatus

1



2

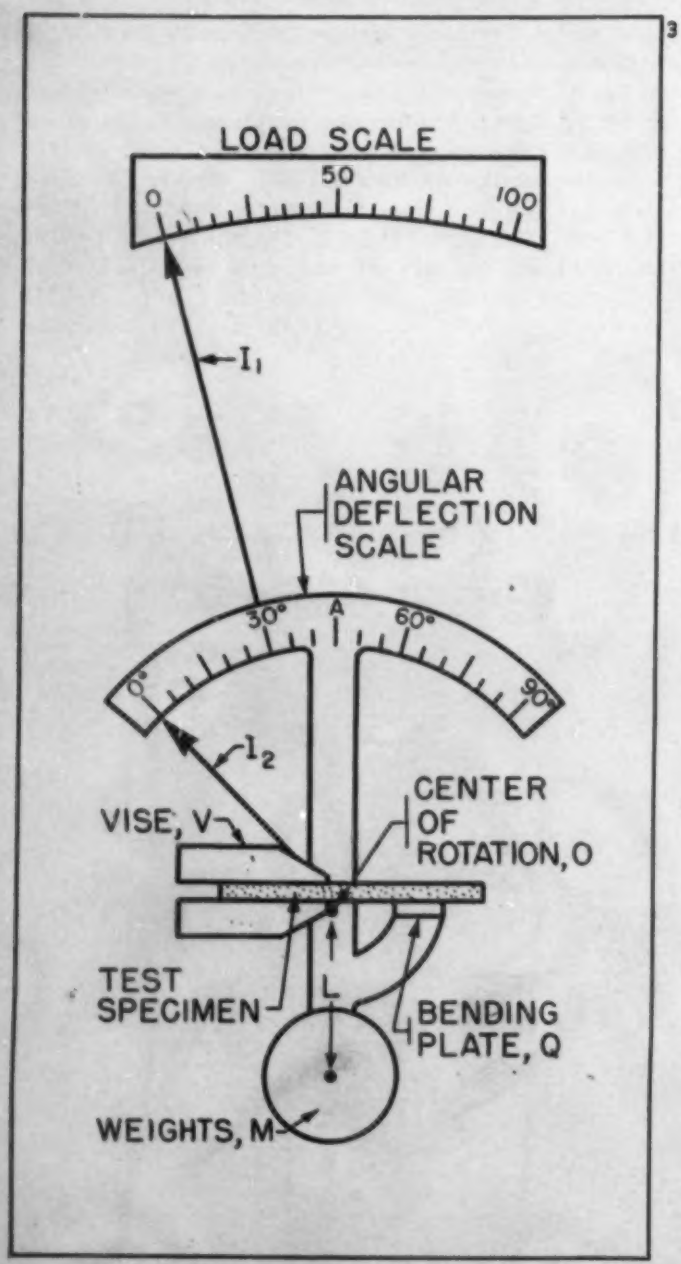


of nonrigid plastics. The work reported herein is restricted largely to a study of these properties at normal and subnormal temperatures.

Stiffness

The stiffness or apparent modulus of elasticity of nonrigid plastics is determined in our laboratory either by method (*a*) or by method (*b*) which will be shown to be equivalent. The choice between them is based entirely on convenience considerations, depending on the temperature facilities available, the stiffness value of the stock, etc. One is a cantilever beam-type test and the other is a torsional method.

Cantilever beam test—The procedure is based on the Olsen stiffness tester,[24] one model of which is illustrated in Fig. 1. Its use for determining the modulus of elasticity of plastics has been reported by Gloor,[6] by Gloor and Gilbert,[8] and by Oberg and his co-workers.[7] The latter group operated the equipment satisfactorily at temperatures as low as −40° C. The ability of the instrument to operate at this temperature and the fact that the equipment combines sensitivity with a wide range, suggested its application to our problems. The evaluation of this test as applied to elastomers was accelerated by the urgent war demand for specifications defining these materials. The problem was undertaken by A.S.T.M. Committee D-20 and the result was the adoption by this group of a method of test for stiffness in flexure (A.S.T.M. Designation D 747 – 43 T) based on this equipment.



The Olsen stiffness tester, Tour-Marshall design, which is shown diagrammatically in Fig. 3, measures the bending moment required to deflect a specimen that is mounted as a cantilever beam. The stiffness, or apparent modulus of elasticity, is calculated from the slope of the initial linear portion of the load-deflection curve (Fig. 4) as follows:

$$E = \frac{4S}{wd^3} \times \frac{M \times (\text{load scale reading})}{100\ \phi} \qquad (1)$$

where E = stiffness in flexure, lb. in.$^{-2}$
S = span length, in.
w = specimen width, in.
d = specimen thickness, in.
M = calibrated weights applied to the pendulum system, and
ϕ = reading on angular deflection scale converted to radians.

Under actual test conditions, the deformation has both elastic and plastic components. The test method does not distinguish between these components nor separate them. Hence, a true elastic modulus is not calculable. Instead, an apparent value is obtained and is defined for purposes of this test as the stiffness of the material in flexure.

Torsion test— The torsion apparatus (Fig. 2) was described in an earlier paper[22] where it was referred to as the "Flex Test." An arbitrary index called the "Flex" temperature, T_F, was determined. This was defined as the temperature at which the material had a modulus of rigidity of 3.1×10^8 dynes cm.$^{-2}$ (4.5×10^4 lb. in.$^{-2}$) and was considered the limiting temperature below which the composition had lost, to an arbitrary extent at least, most of its elastomeric characteristics. The test procedure has since been generalized to permit calculation of the apparent modulus of elasticity (assumed to be three times the modulus of rigidity) of a stock over a temperature interval. Thus T_F (stiffness or apparent modulus of elasticity = 135,000 p.s.i.) becomes merely one point on the stiffness-temperature curve.

It has been shown[21] that the torque required to twist a right prism of rectangular cross section is given by the equation:

$$T = ab^3\mu G\frac{\phi}{L} \qquad (2)$$

where T = torque or moment of couple in the plane of cross section
$2a$ = specimen width
$2b$ = specimen thickness
$\mu = f(a/b)$
G = modulus of rigidity
ϕ = angle of twist of the torque head (5 sec. after load application), and
L = span length of the specimen.

Equation (2) is applicable to the Bakelite Corporation's torsion test only as a first approximation. This restriction is imposed because of the failure of the test conditions to comply exactly with all of the boundary conditions set up in the theoretical approach to the problem. The specimen under test conditions is not free to contract longitudinally as it is twisted; hence a tension stress is superposed on the distribution of

stress described by the mathematical treatment. Despite this, the agreement between theory and experiment was found to be quite satisfactory at least as regards the effect of thickness on T_F. Thus it was indicated that constant span length during test did not change the functional form of the solution or that the restoring torque due to the superposed tension stress was comparatively small for the strains realized experimentally. Also the stiffness or apparent modulus of elasticity calculated from torsion test data was in good agreement with that obtained in flexure as will be shown later.

If equation (2) is solved for G, and E (the stiffness or apparent modulus of elasticity) is assumed equal to $3G$, i. e., Poisson's ratio = 0.5, then

$$E = \frac{3TL}{ab^3\mu\phi} \qquad (3)$$

Figure 5 is a graph of equation (3), log E vs. ϕ for a range of values of the specimen thickness, $2b$, from 0.040 to 0.100 in., and where $2a$ = 0.250 in., L = 1.50 in., and T = 0.505 in. pounds. From this graph the stiffness value may be read directly if the angular deflection and the thickness are known.

A typical set of torsion data is shown in Fig. 6. From this the stiffness-temperature data of Table I were obtained using the graph of Fig. 5.

Correlation of cantilever and torsion stiffness methods

The correlation between stiffness in flexure and stiffness in torsion was obtained as follows: The Olsen stiffness tester

3—An enlarged diagrammatic view of one design of the Olsen stiffness tester. 4—Stiffness is calculated from the slope of the initial linear portion of the load-deflection curve. 5—This is a graph of equation (3). 6—This curve illustrates a typical set of torsion data

4

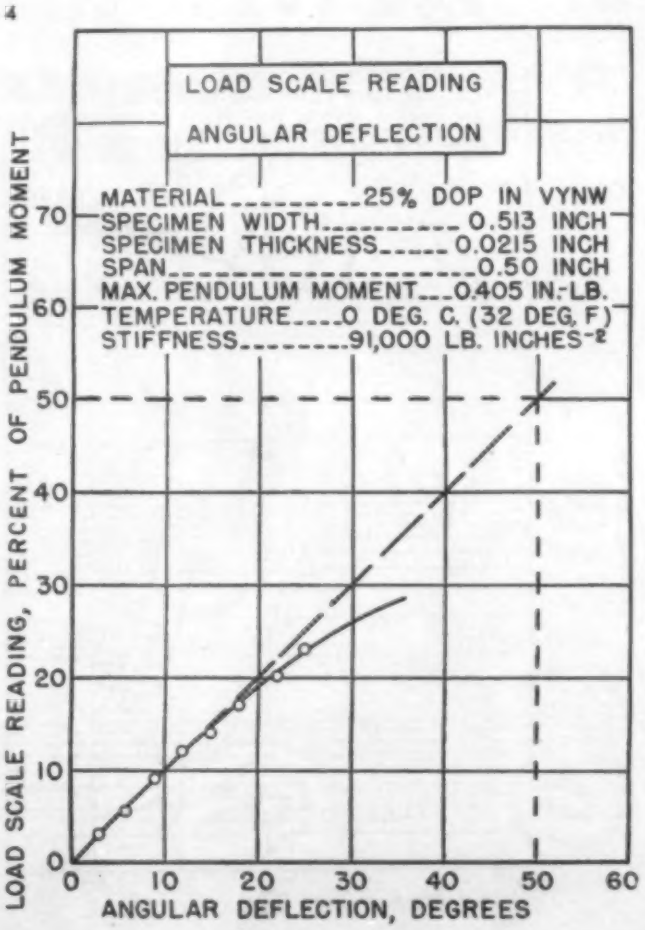
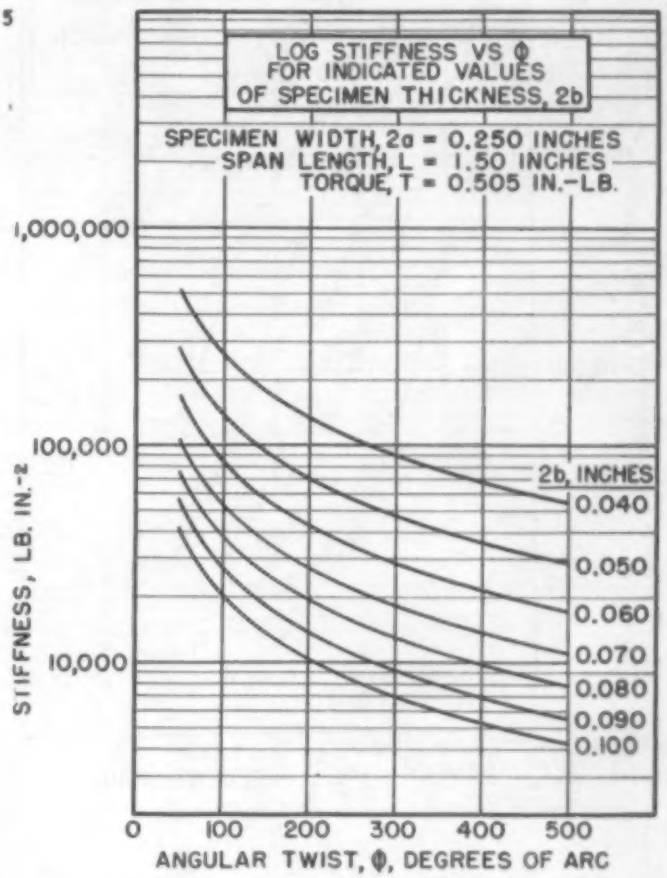


Table I.—Stiffness-Temperature Data for Vinyl Chloride-acetate Resin VYNW Containing 25 Percent Dioctyl Phthalate

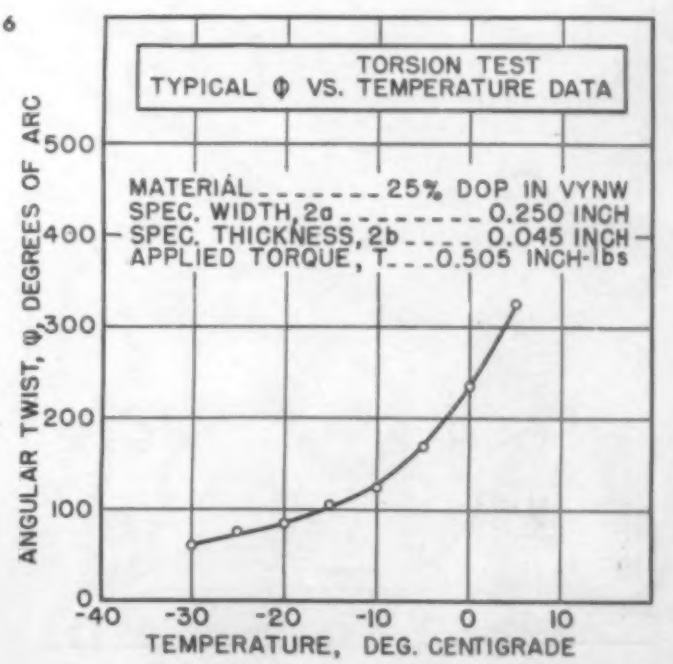
Thickness of specimen: 0.045 in.

Temperature	ϕ	*Stiffness*
° *C.*	*deg. of arc*	*lb. in.*$^{-2}$
−30	60	330,000
−20	85	230,000
−10	125	155,000
0	235	83,000
+ 5	325	60,000

5



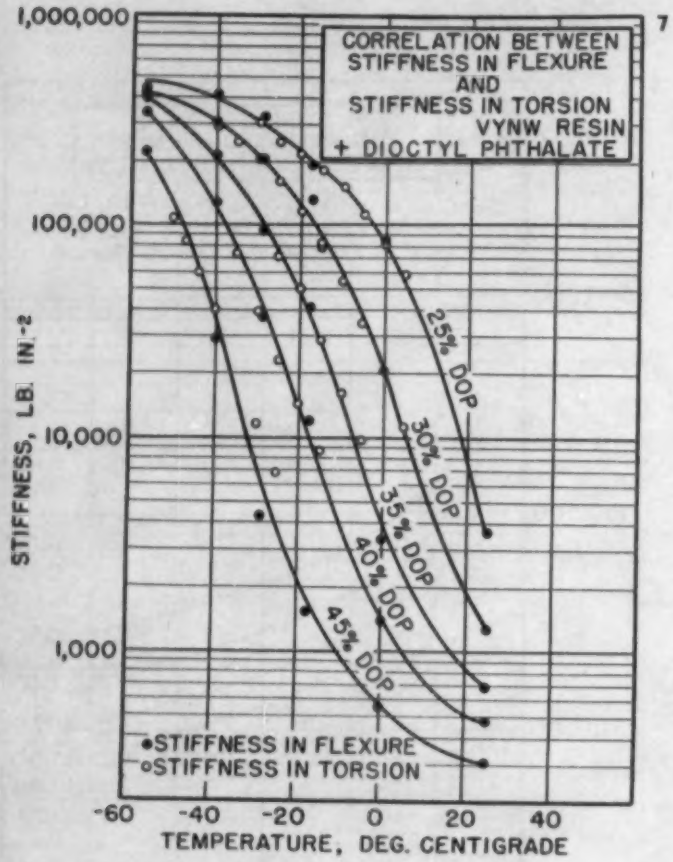
6



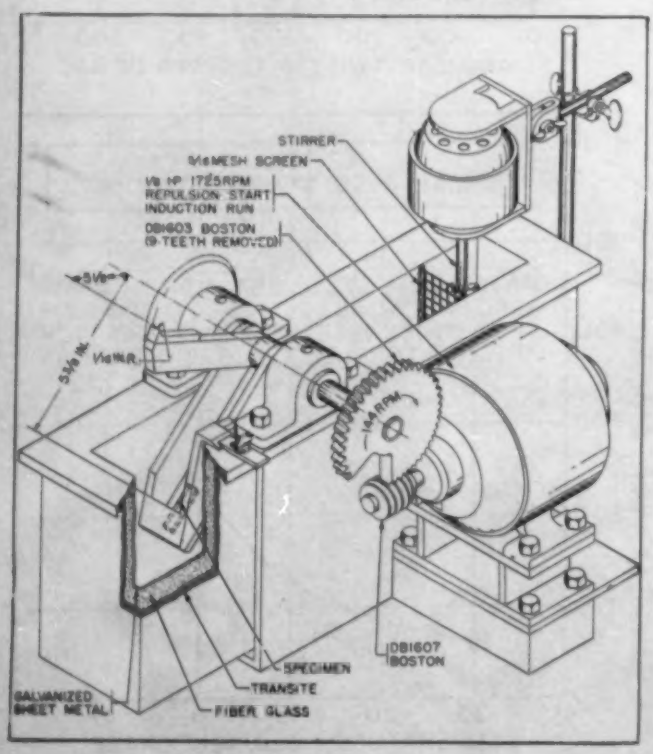
was prepared for low temperature use by removing the lubricants in the motor and gear box. In the models in which the weighing system is supported on knife edges, no lubricant addition is required. However, where the weighing system is mounted in bearings, it was found desirable to use a few drops of kerosene in order to insure reliable load readings. With these changes, stiffness in flexure measurements were made on 5 compounds containing 25 to 45 percent dioctyl phthalate (DOP) in vinyl chloride-acetate resin VYNW at 6 temperatures in the range −56.7° C. (−70° F.) to +25° C. (+77° F.). The 5 compounds were then tested on the torsion apparatus, and the stiffness values by both methods plotted on Fig. 7, log stiffness vs. temperature. It will be noted that the agreement between the two sets of data is good. It is emphasized that this correlation has been established only for plasticized vinyl chloride-acetate resin compounds. Serious discrepancies between the results of the two methods, attributed to low proportional limit, have been observed for some materials.

Having established the above correlation experimentally, both instruments have been used interchangeably in the stiffness determinations of vinyl chloride-acetate elastomers. The choice of one over the other is based on convenience considerations. For example, in our laboratory the torsion test is more convenient to use at subnormal temperatures and in the stiffness range 5000 to 500,000 p. s. i., and the 0.5 in. lb. Olsen tester is regularly used at 0 and 25° C. (where we have the facilities of controlled temperature rooms) and in the stiffness interval below about 10,000 p. s. i. Either equipment can be used successfully over the entire range by adjusting specimen dimensions to suit sensitivity requirements of each.

7



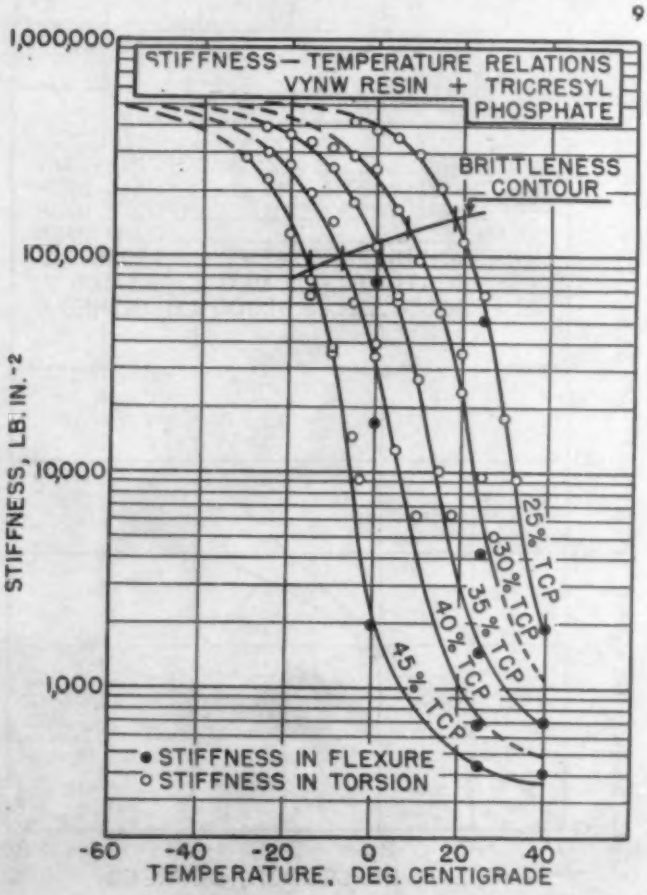
8



Brittleness

The stiffness of a plastic is used to define its resistance to "elastic" deformation under low rates of loading. It is not simply related to the material's ability to withstand fracture under impact (high rate of deformation) conditions. Yet this latter property is equally important in defining the low temperature characteristics of rubber-like materials. It would be desirable to be able to evaluate the resistance to impact over a wide range of temperatures and rates of deformation. However, this general approach poses some mechanical problems which have limited considerably the versatility of the brittleness machines developed to date. Hence most brittleness tests for elastomers are of the "spot" type and

9



determine the temperature of failure at a given rate of loading, the rate of loading required to cause failure at a given temperature,[17] or the occurrence or non-occurrence of failure at fixed loading and temperature.[14] For this investigation the first of these tests was chosen.

Brittleness apparatus

This apparatus and test were developed at the Bell Telephone Laboratories[12–13] and have since been adopted by the American Society for Testing Materials as a Tentative Method of Test for Brittleness of Nonrigid Plastics (A.S.T.M. Designation D 746–43 T). Our version of the apparatus conforms to the requirements of A.S.T.M. D 746, but embodies several minor mechanical modifications. These are:

1. The sample (1.50 × 0.25 × 0.075 in.) is mounted on a stationary yoke rather than on the moving arm.
2. The moving arm, which starts from rest, moves through an arc of about 270° before it strikes the specimen.

These were necessary in order to use a reasonably available (on the current market) motor whose starting characteristics were such that at least 5 revolutions were required before it came up to its rated speed. This set-up insured the specified speed (6.5 ± 0.5 ft. per sec.) of impact with our motor.

A phantom view of our brittleness tester is shown in Fig. 8. The brittleness temperature was obtained with it according to D 746 and is defined as the lowest temperature of non-failure of 5 consecutive test specimens of a given material.

Specimen preparation

A standard method of sample preparation was adopted and followed throughout this investigation in order to control processing variables. The general formula used in this investigation consisted of:

	Wt., percent
Vinyl chloride-acetate resin	97-x
Plasticizer(s)	x
Stabilizers and lubricants	3
Total	100

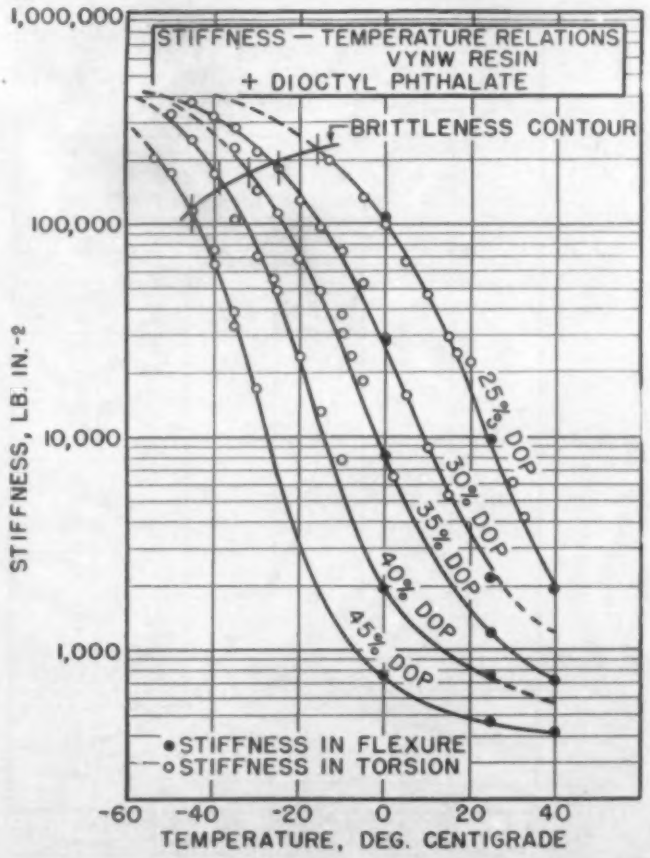
The ingredients (500-gm. batch) were thoroughly preblended in a kitchen-type mixer, fluxed and milled for 6 min. on a 16 × 8 in. 2-roll equal-speed mill at 140–145° C. The milled sheet was molded to thicknesses of 0.040 and 0.075 in., and the sample conditioned in air at 25° C. for a minimum of 40 hr. before testing. It was established that humidity control during conditioning was not necessary for these vinyl plastics due to their excellent moisture resistance. Specimens of the required dimensions for each test were cut from the molded sheets by means of a steel die. Specimens for testing on the Olsen stiffness machine at subnormal temperatures were further conditioned for 16 hr. minimum, in air at the test temperature.

Experimental results and discussion

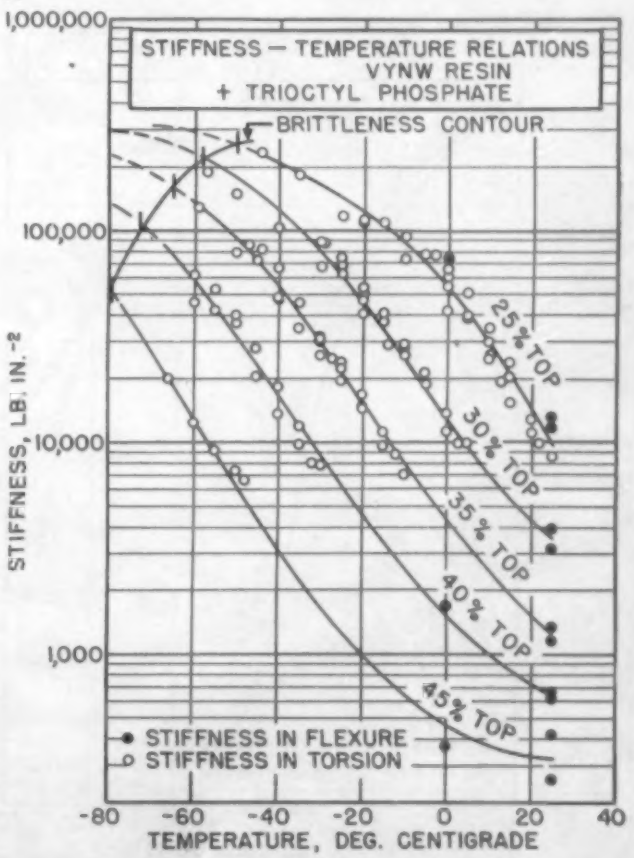
The stiffness and brittleness characteristics of 3 series of plasticized compounds (all using the same lubricants and stabilizers which were, however, different from those of the compounds of Fig. 7) based on vinyl chloride-acetate resin VYNW are shown in Figs. 9, 10 and 11. Figure 9 covers a range of concentrations of plasticizer tricresyl phosphate; Fig. 10, plasticizer dioctyl phthalate; and Fig. 11, trioctyl

7—A graph showing stiffness values obtained when the 5 compounds were tested by both methods. **8**—*A phantom view of the brittleness tester.* **9**—*This graph, log stiffness vs. temperature, covers a range of concentrations of the plasticizer tricresyl phosphate.* **10**—*These curves show similar data for the plasticizer dioctyl phthalate.* **11**—*Similarly, this graph shows the stiffness data for the plasticizer trioctyl phosphate*

10



11

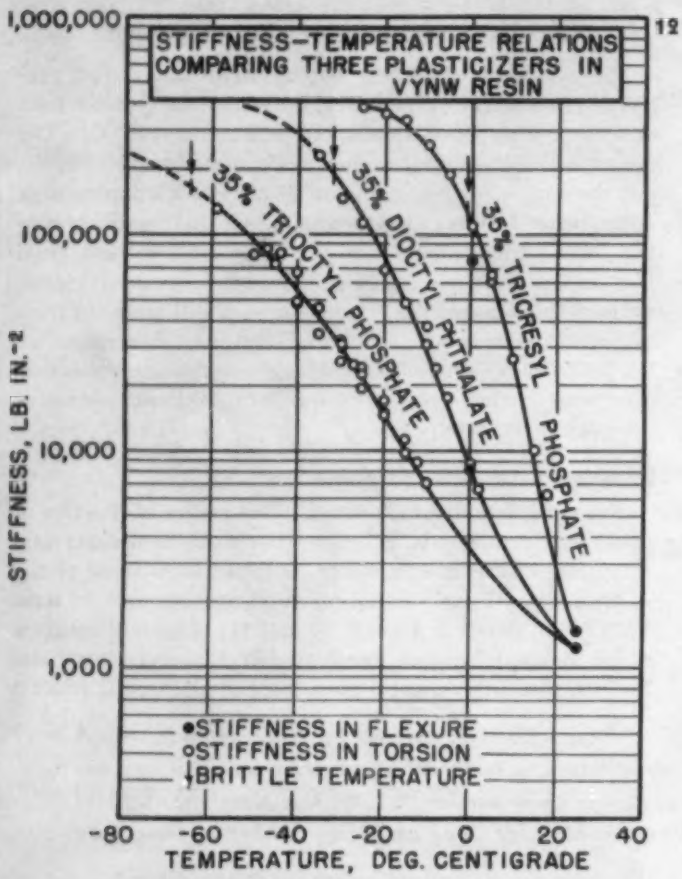


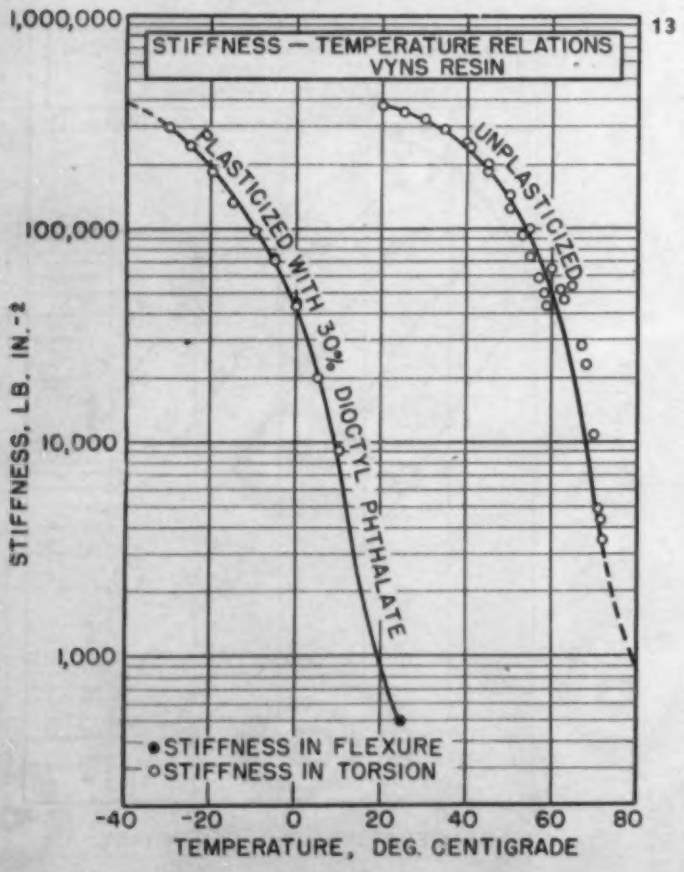
phosphate. Attention is called to the inverted "S"-shaped families of curves representing the log stiffness-temperature function for these plasticizers in the concentration range 25–45 percent. Plasticizer addition above 25 percent appears only to translate the curves toward lower temperatures. The brittleness contour superposed on the stiffness curves shows that impact failure is not simply related to stiffness but includes other factors, among them plasticizer type and concentration. In addition, it will be noted that the 3 plasticizers have the same sort of effect on both properties but to widely different degrees.

The stiffness properties imparted to resin VYNW by the 3 plasticizers of Figs. 9, 10 and 11, all in 35 percent concentration, are compared in Fig. 12. It will be noted that all 3 compounds have about the same stiffness at room temperature but are widely different at subnormal temperatures. It is generally desirable in practice to have a flat stiffness-temperature characteristic. Trioctyl phosphate yields a compound having a low degree of temperature sensitivity, at least as compared to tricresyl phosphate, which is poor. Dioctyl phthalate is intermediate in this respect.

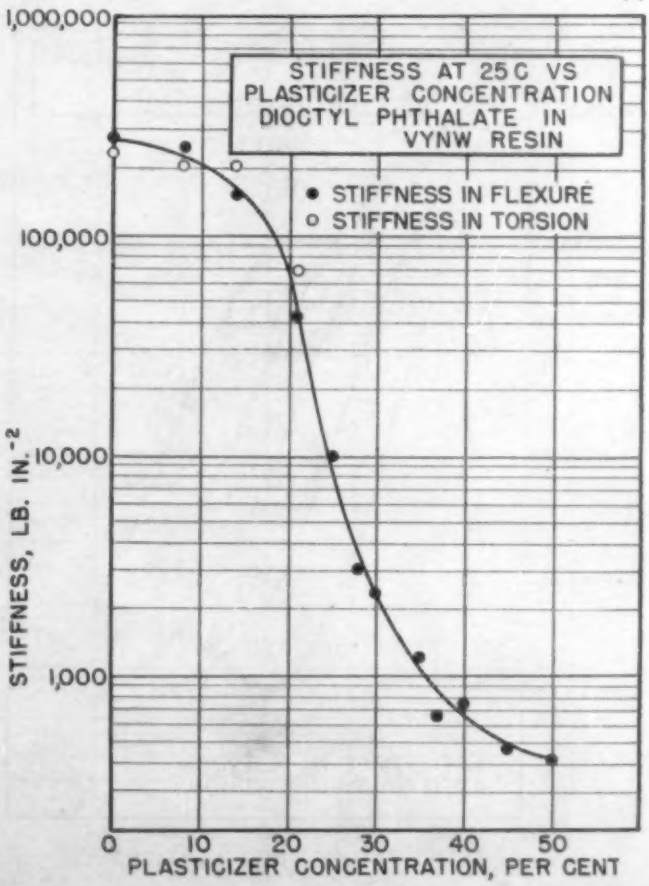
Our impression is that dioctyl phthalate addition to resin VYNW merely translates the log stiffness-temperature characteristic of the unplasticized resin along the temperature axis. Other plasticizers, for example, tricresyl phosphate and trioctyl phosphate, modify the slope of the steep portion of the curve in addition to displacing it. Each plasticizer then has a specific effect on both the slope of the curve and the amount by which the characteristic is displaced.

An example of the unplasticized resin compound characteristic in comparison with that of the same resin plasticized with 30 percent dioctyl phthalate is given in Fig. 13. It will be noted that the plasticizer (*Please turn to page 160*)





***12**—This graph compares stiffness properties imparted to resin VYNW by 3 different plasticizers, all in 35 percent concentration.* **13**—*Example of unplasticized resin compound characteristic in comparison with that of the same resin plasticized with 30 percent dioctyl phthalate.* **14**—*This graph shows stiffness at 25° C. as a function of the dioctyl phthalate concentration in the compound*



Effect of environmental conditions on mechanical properties of organic plastics

by T. S. CARSWELL and H. K. NASON†

PART II

Part I of this article appeared on pages 121–126, 158, 160 of the June issue of MODERN PLASTICS. *The full list of references mentioned in both Part I and Part II appeared at that time. Space limitations forbid the reprinting of these references, and readers are asked to consult the listing on pages 126, 158 and 160 of the June issue.*

Continuous heat effects

The preceding data indicate the strength properties of plastics in thermal equilibrium with their environment; relatively short times of exposure at each temperature are involved. Continuous exposure for long periods of time may produce degradative changes, and the effect on mechanical properties of such long-time exposure at elevated or reduced temperatures is an important matter which must be studied carefully. Considerable data of this type have been made available recently (4, 8, 22, 28, 33, 43, 49, 56, 61, 63, 79, 84, 103, 111, 116, 126).

Thermoplastics in general soften and lose their mechanical usefulness at temperatures below those which cause serious thermal decomposition on degradation. Plastics based on cellulose nitrate are an exception; these may lose in strength and ductility and become brittle upon prolonged exposure to temperatures as low as 122° F. due to thermal degradation of the cellulose nitrate molecule. Continuous exposure to temperatures slightly below the softening point will cause appreciable loss of plasticizer from many types, however, with resultant increase in stiffness and strength, and decrease in ductility and toughness.

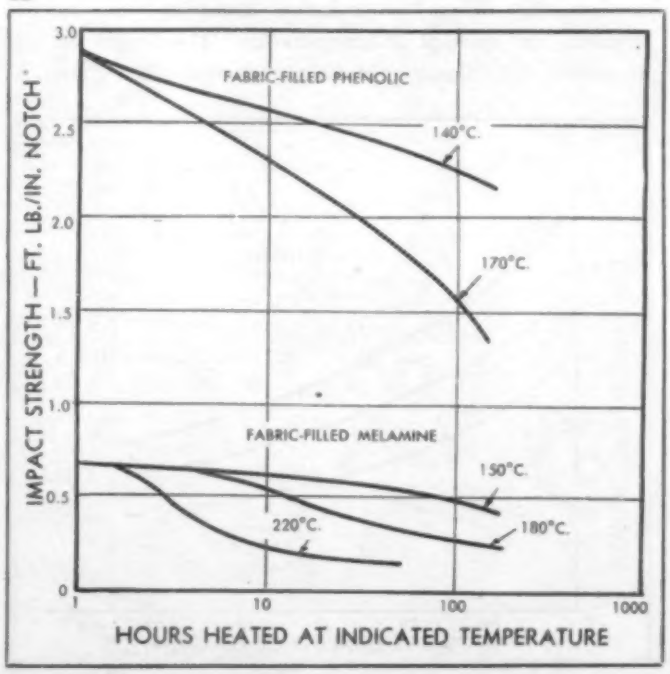
Thermosetting materials, on the other hand, ordinarily exhibit no well-defined softening point, and many of these plastics retain good mechanical properties up to fairly high temperatures. With such materials, prolonged exposure may lead to decomposition with a resultant decrease in strength. In general, the thermosetting resins themselves do not show appreciable thermal degradation below about 390° F., and mineral-filled compositions remain usable under continuous exposure to temperatures at least as high. Cellulose-filled compositions, however, are seldom satisfactory for continuous use above about 265–300° F., since cellulose itself suffers considerable breakdown and loss of strength at temperatures above 250° F. Figure 22 shows the effect of continuous exposure to several elevated temperatures on the impact strength of two cotton fabric-filled thermosetting plastics (8, 22). The test specimens, after exposure at the elevated temperature, were cooled to 77° F. (25° C.) before testing. Figures 23 and 24 show effect of temperature on flexural and impact strength, respectively, after 162 hr. continuous heating (8, 22). Tendency of rubber compounds to

* Presented at the A.S.T.M. Symposium on Plastics held in Philadelphia, Pa., on Feb. 22–23, 1944, and published here through the courtesy of the American Society for Testing Materials.

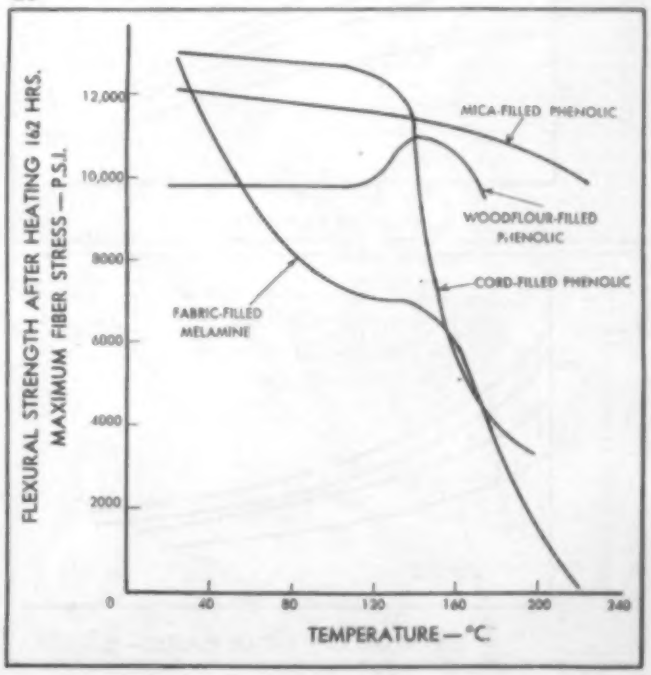
† Research Dept., Plastics Division, Monsanto Chemical Co.

22—*Effect of continuous heating on impact strength of thermosetting plastics.* **23**—*This graph shows effect of continuous heating on the flexural strength of thermosetting plastics*

22



23



get weak and brittle when heated in air is well known (132).

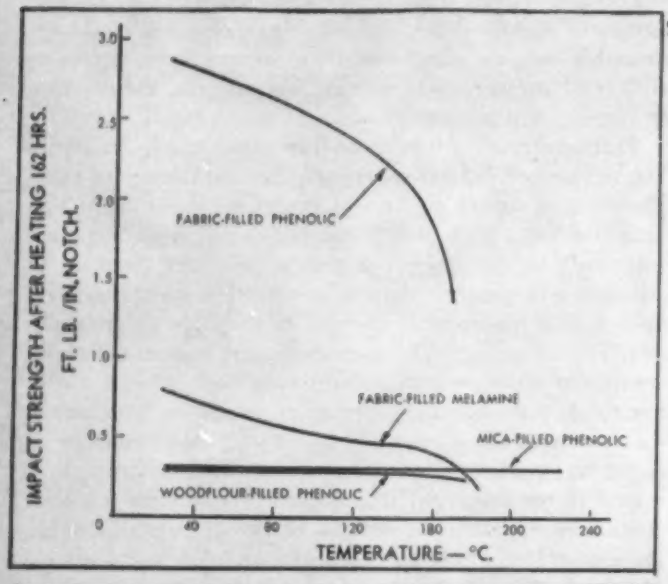
Prolonged exposure to sub-zero temperatures has relatively little permanent effect on the strength properties of most plastics unless cracking or checking occur, or unless a slowly reversible crystallization takes place. Cracking or checking will occur where ductility at low temperature is too small to equalize strains set up by shrinkage or dimensional changes around inserts. Crystallization is rarely encountered but may occur in materials of well-ordered molecular structure.

Moisture effects

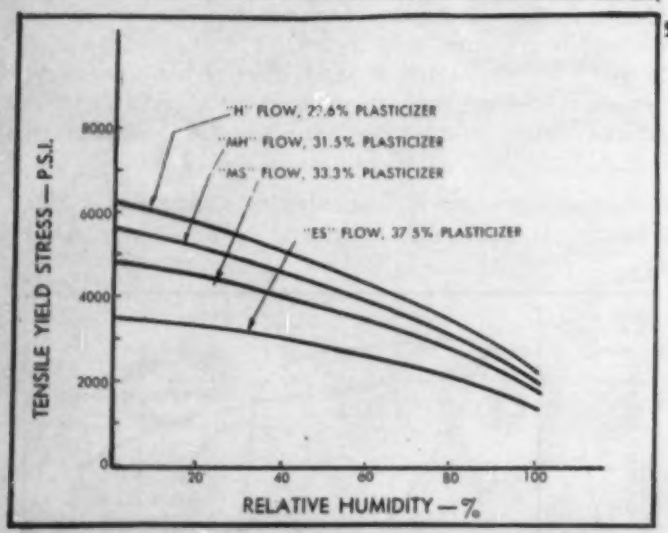
The moisture content of the atmosphere, like the temperature, is subject to wide variation. Saturated air at −40° F. contains only 0.0079 percent, by weight, of water vapor. Such air if warmed to room temperature (70° F.) would have a relative humidity of only 0.6 percent. Such dry conditions are common in the northern parts of our country during the winter months. On a 90° F. day with 70 percent relative humidity, a common summer condition, the air contains 4.1 percent, by weight, of moisture, and contents from 7.5 to 10 percent are common under jungle conditions. Hence, normal seasonal variations in the moisture content of the atmosphere are large and will produce similarly large variations in the moisture content of hygroscopic materials exposed thereto. Many organic plastics are hygroscopic to a greater or lesser degree.

Water acts as a powerful plasticizer for many plastics, and tends to reduce strength and modulus, while increasing ductility and toughness. The extent of these effects is roughly proportional to the amount of water absorbed by the material. Plastics which are capable of absorbing a large amount of moisture are more affected than those which absorb little. In general, cellulose compounds, protein derivatives and polyamides (i.e., those compounds with hydrophilic OH, COOH or NH groups) are sensitive to moisture while compounds poor in oxygen and nitrogen but rich in carbon, hydrogen or halogen are moisture resistant.

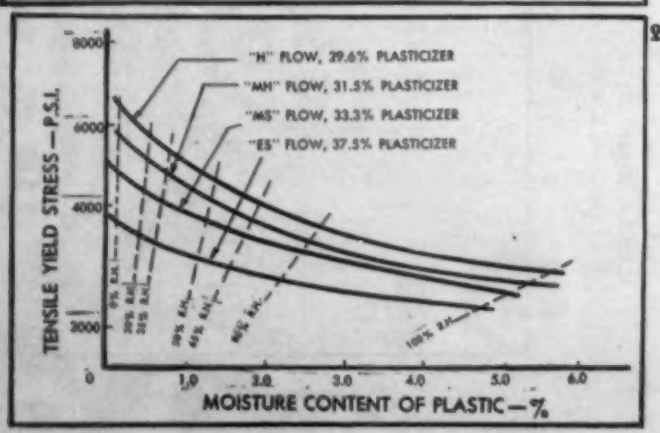
Quantitative data showing the effect of moisture content on mechanical properties have been scarce until lately, but considerable recent information along these lines is now available (2, 11, 12, 31, 36, 46, 63, 64, 80, 84, 108, 112, 120, 123, 135, 138). Figures 25 to 30, inclusive, show the effect of moisture on tensile, compressive and impact properties of four cellulose acetate formulations, differing only in plasticizer content, at 25° C. Cellulose acetate is a fairly hygroscopic plastic, and its behavior is typical of such materials.



24

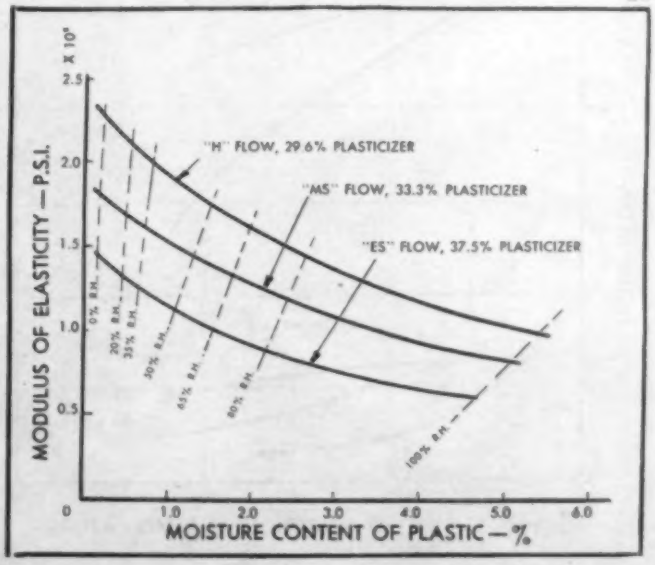

"H" FLOW, 29.6% PLASTICIZER
"MH" FLOW, 31.5% PLASTICIZER
"MS" FLOW, 33.3% PLASTICIZER
"ES" FLOW, 37.5% PLASTICIZER
TENSILE YIELD STRESS — P.S.I.
RELATIVE HUMIDITY — %

25


"H" FLOW, 29.6% PLASTICIZER
"MH" FLOW, 31.5% PLASTICIZER
"MS" FLOW, 33.3% PLASTICIZER
"ES" FLOW, 37.5% PLASTICIZER
TENSILE YIELD STRESS — P.S.I.
MOISTURE CONTENT OF PLASTIC — %

26

***24**—Effect of continuous heating on impact strength of thermosetting plastics. **25**—Effect of relative humidity on the tensile yield stress of cellulose acetate (injection molded). **26**—Effect of moisture on tensile yield stress of cellulose acetate. **27**—Effect of moisture on the modulus of elasticity of cellulose acetate. **28**—Effect of moisture on flexural strength of cellulose acetate. **29**—Effect of moisture on the impact strength of cellulose acetate. **30**—Effect of relative humidity on tensile strength of several thermoplastics. **31**—Effect of 21 percent hydrochloric acid on shear strength of plastics*


MODULUS OF ELASTICITY — P.S.I.
"H" FLOW, 29.6% PLASTICIZER
"MS" FLOW, 33.3% PLASTICIZER
"ES" FLOW, 37.5% PLASTICIZER
MOISTURE CONTENT OF PLASTIC — %

27

Data are presented in two ways—as a function of 1) the relative humidity of the air in which the specimens were conditioned for six weeks, and 2) the moisture content of the specimens at the time the tests were made. Figure 25 shows the effect of relative humidity on tensile yield stress, and Fig. 26 shows the relation between moisture content and tensile yield stress. It will be noted that plasticizer content affects not only the strength but also the sensitivity to moisture. Figures 27, 28 and 29 show the relationship between moisture content and modulus of elasticity, flexural strength and impact strength, respectively, for these same cellulose acetate formulations. Figure 30 shows relationship between relative humidity and tensile strength for several thermoplastics.

Data for thermosetting plastics is still scarce and very little complete information is available for these materials. One investigator (48) has recently shown that the compressive strength of fabric-filled phenolic moldings is changed as much as 25 percent by comparatively small changes in moisture content.

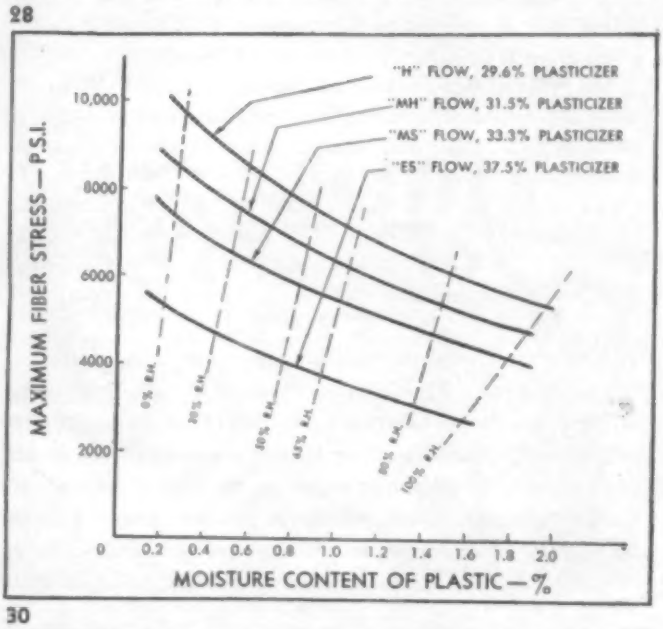
All of the preceding data are for variations in moisture content at room temperature. Where both temperature and relative humidity are changed, the effect on strength properties may be more pronounced. Combination of high temperature and high humidity is especially severe on most materials and may produce permanent damage in some materials by inducing chemical degradation, loss of plasticizer, etc. Similarly, prolonged exposure to moisture or to the leaching action of liquid water may produce considerable permanent damage (33, 50, 74, 116, 147).

Chemical agents

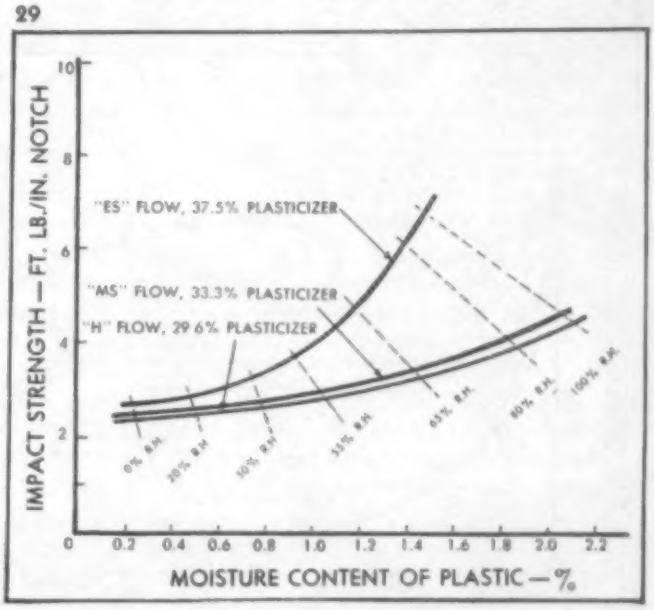
Chemicals may act on plastic materials in a number of ways, e.g.: 1) they may dissolve the material, 2) they may attack the material and decompose it chemically either partially (weakening) or completely (destruction), 3) they may extract plasticizer or other components and thus alter properties and 4) they may be absorbed by the plastic and thus affect strength. In addition they may, of course, affect dimensional stability, finish, appearance, electrical properties, optical properties, etc., without seriously affecting mechanical properties.

The effect which a chemical will have on any plastic depends upon the chemical nature of the two and can be determined best by practical experiments. Tables showing qualitatively the behavior of plastics with many types of reagents are available (4, 75, 112). Quantitative data are more scarce although some good information has been published recently. Some information on the effect of a number of chemicals on impact and flexural strengths of molded phenol plastics are available (41) and valuable data showing the effect of chemicals and solvents on the shear strength of a number of plastic materials have recently been published (36, 37). Figure 31, taken from this work, shows the effect of 6.5 N hydrochloric acid (21 percent) on the shear strength

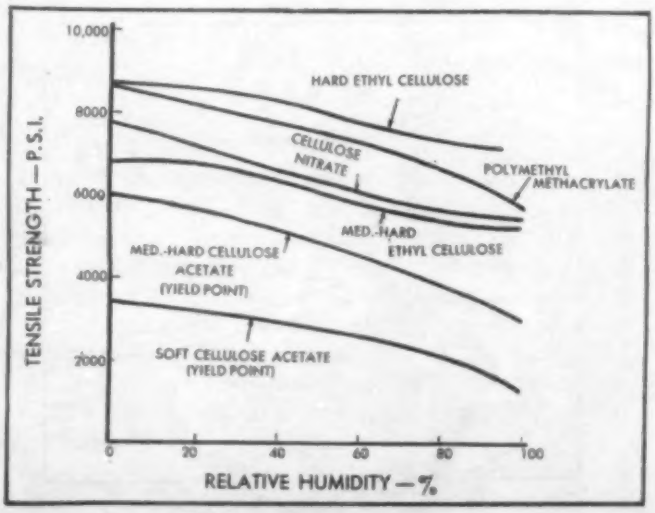
28



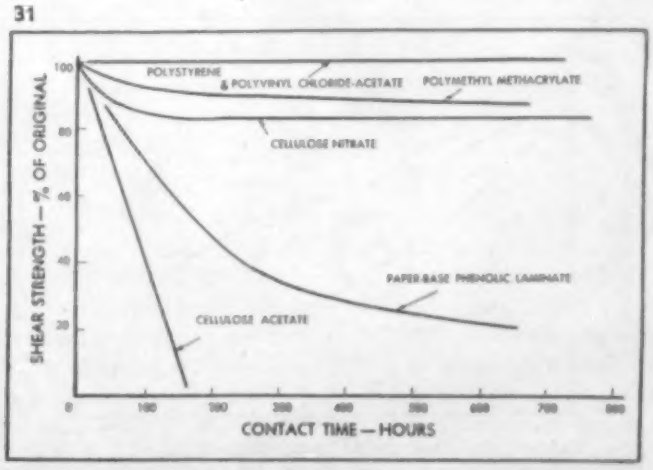
29

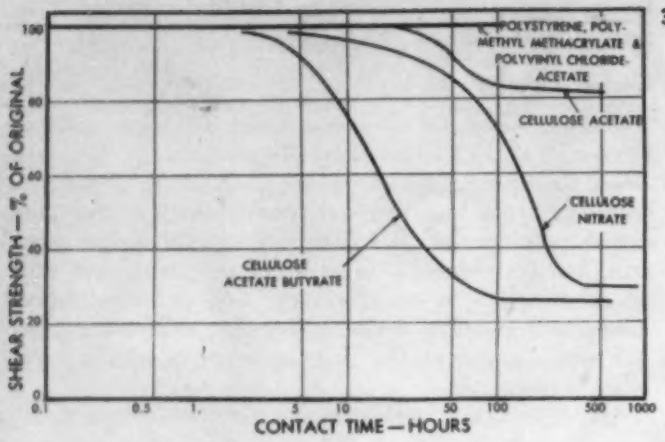


30

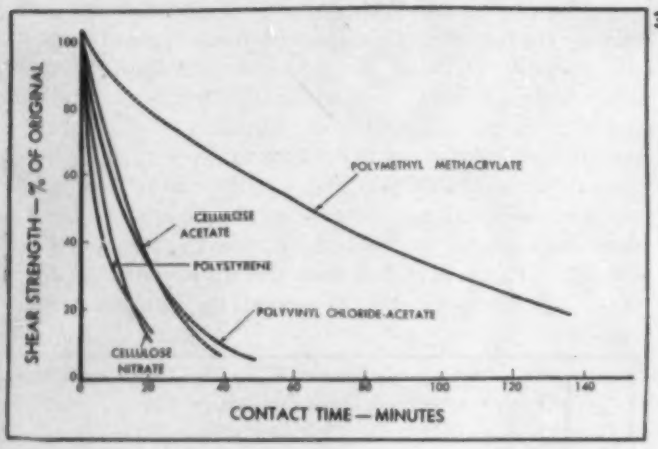


31

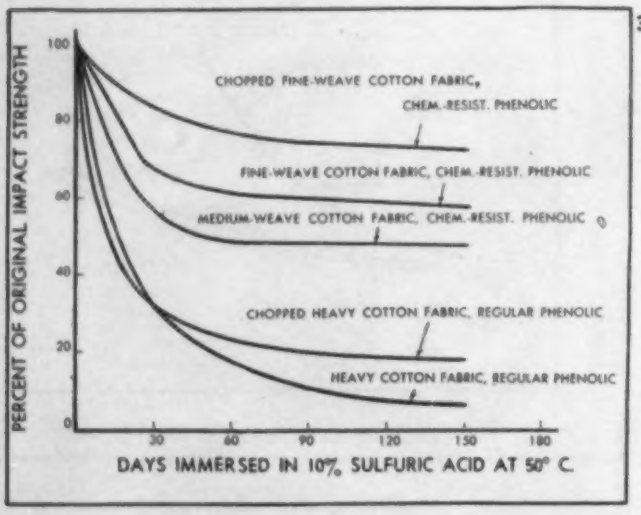




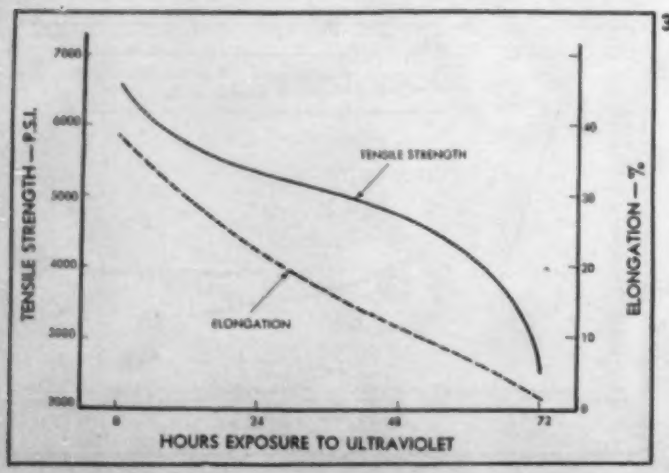
32



33


PERCENT OF ORIGINAL IMPACT STRENGTH
DAYS IMMERSED IN 10% SULFURIC ACID AT 50° C.
CHOPPED FINE-WEAVE COTTON FABRIC, CHEM.-RESIST. PHENOLIC
FINE-WEAVE COTTON FABRIC, CHEM.-RESIST. PHENOLIC
MEDIUM-WEAVE COTTON FABRIC, CHEM.-RESIST. PHENOLIC
CHOPPED HEAVY COTTON FABRIC, REGULAR PHENOLIC
HEAVY COTTON FABRIC, REGULAR PHENOLIC

34



35

of several plastics. Figure 33 shows the effect of a typical organic solvent, acetone. Figure 32 shows the effect of a typical non-solvent butyl alcohol. It should be noted that temperature has a pronounced effect on the activity of chemicals. The above data are for tests at a room temperature of 77° F.; increasing the test temperature may increase the effect of the chemical manyfold.

• Good data also have been published recently showing the effect of acids and alkalis on the tensile, compressive, impact and bond strengths of a number of phenolic laminates (42, 131). Figure 34 shows some data on the effect of immersion in 10 percent sulfuric acid at 122° F. on impact strength.

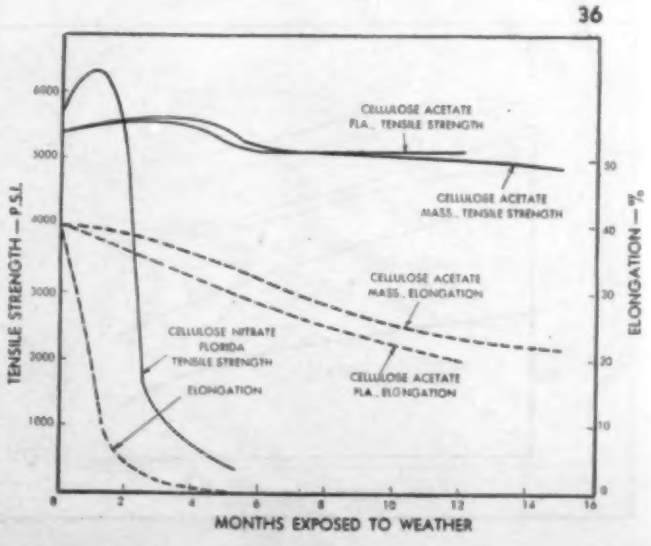
Practical testing under conditions duplicating those of the intended application is the only reliable way to evaluate the suitability of a plastic for uses involving contact with chemicals. Quantitative data of the type shown above would be very helpful, however, and it is hoped that more work of this type will be published.

Light

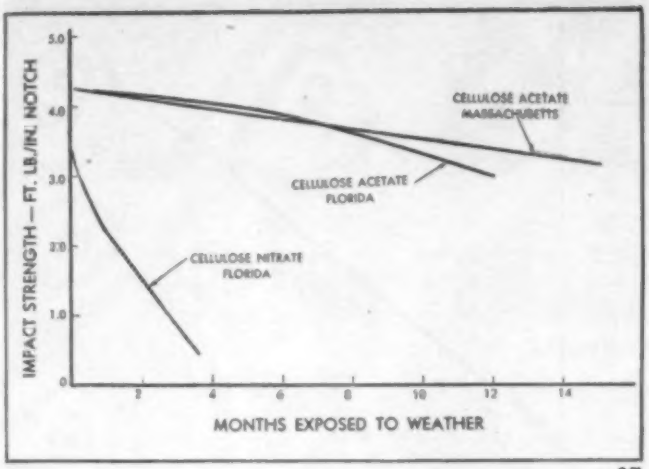
Continuous exposure to light will cause chemical change in almost any organic material, and plastics are no exception. The ultraviolet portion of the spectrum is especially active in this respect. The change may vary in kind and severity from slight yellowing to complete disintegration. The principal effects of irradiation on mechanical properties are tied up with the chemical degradation of the polymeric compound and appear as reduced strength, reduced ductility and increased fragility (4, 49, 56, 61, 73, 78, 95).

The resistance of a plastic to these changes depends largely upon its chemical constitution and formulation although physical form, color and internal stress condition are sometimes of importance. No general rules of behavior can be formulated, and each plastic must be studied individually to determine its sensitivity to degradation by light. The difficulty of doing this in a quantitative manner is considerable, and the technical literature contains a great many con-

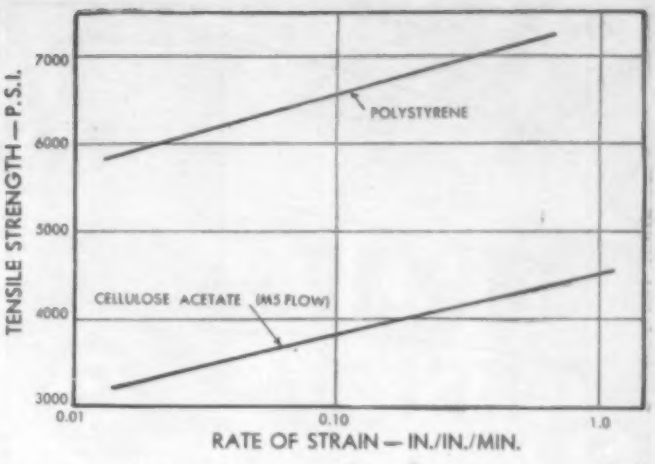
***32**—Effect of butyl alcohol on shear strength of several thermoplastics.* ***33**—Effect of acetone on shear strength of several thermoplastics.* ***34**—Effect of immersion in 10 percent sulfuric acid on impact strength of laminated phenolics.* ***35**—Effect of exposure to ultraviolet light on tensile properties of cellulose nitrate sheet plastic.* ***36**—Effect of exposure to weather on tensile properties of cellulose acetate and cellulose nitrate sheet plastics*



36



37



38

37—*Effect of exposure to weather on impact properties of cellulose acetate and cellulose nitrate sheet plastics.*
38—*Effect of rate of straining on the tensile strength of injection-molded polystyrene and cellulose acetate*

flicting qualitative statements regarding the light stability of various materials.

Figure 35 (84) shows the way in which the tensile strength and elongation of cellulose nitrate, a relatively light-sensitive plastic, are affected by exposure to ultraviolet radiation (S-1 sunlamp). Such radiation causes breakdown of the cellulose nitrate molecule, both denitration and cleaving of the cellulose chain taking place, and leads to loss of strength, ductility and toughness and, eventually, to complete disintegration. Similar data are needed for other materials.

Oxygen

Like all organic materials, plastics are subject to oxidation. High temperatures and light accelerate the effects, but over long periods of time oxidative changes can take place even at room temperature. Susceptibility to oxidation varies widely and depends largely upon the chemical nature of the plastic. In general, the more double bonds present in the molecule, the greater will be the effect of exposure to oxidizing conditions. Under mild conditions, yellowing and gradual loss of strength and ductility are the principal results.

Rubber is notoriously subject to oxidative degradation with resultant stiffening, embrittlement and eventual loss of strength and elasticity. Tests for resistance to oxidation are routine in the rubber industry, and the literature in this field is voluminous. Most synthetic elastomers are more resistant to oxidation than rubber. Some, in fact, are so resistant that they cannot be evaluated adequately by the tests used for rubber. Rigid plastics are, in general, resistant to purely oxidative agents under mild conditions. Few quantitative data are available.

Composite effects (weathering)

In actual use, a plastic component is seldom subjected to only one environmental factor such as heat, cold, moisture, light, oxidation. Several or all, working together, are usually involved, and in many cases a cyclic exposure to all factors over a wide range of conditions is encountered. The effect on mechanical properties of combined freezing and thawing, wetting and drying, heating and irradiating, all in the presence of oxygen and frequently of other chemicals, is usually much more severe than would be the effect of any single factor.

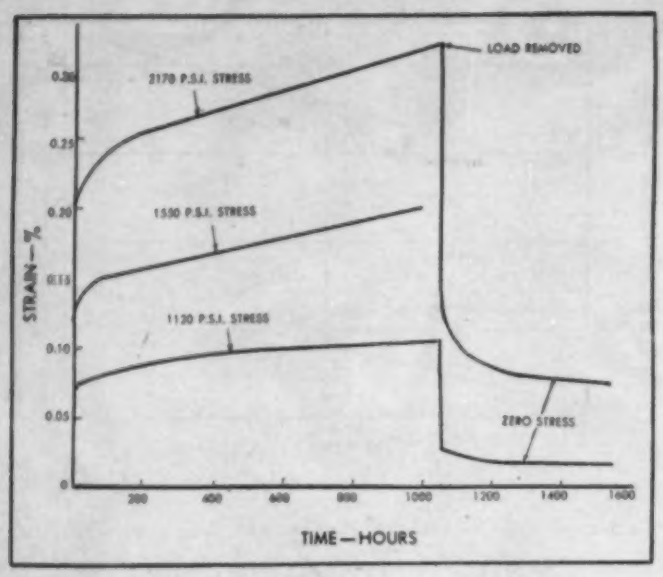
Exposure to the weather involves such cyclic effects and constitutes one of the most severe environmental conditions which an organic material may be called upon to withstand. Even here the matter is not a simple one because there are all sorts of climates in the world and a plastic must be tested in each to determine how it will behave. No completely reliable laboratory test for determining weatherability is yet available although ceaseless work toward this end has been carried on for many years (73, 95, 156). To determine how a material will weather, it must be exposed to the weather under every climatic condition for which data are needed. Naturally, such work is time consuming. A great deal of information on resistance to weathering has been accumulated but very little of it pertains to mechanical properties except in a qualitative way (4, 50, 67, 68, 73, 95, 112, 155). Quantitative data for a variety of materials are needed.

Figures 36 and 37 show the effect of exposure to weather in Florida (sub-tropical) and in Massachusetts (cool, temperate) on the tensile strength, elongation and impact strength of cellulose acetate and cellulose nitrate sheet plastics (84). The type of behavior is typical of thermoplastics, although other materials may, of course, vary in degree. The changes are of a degradative type, all mechanical properties deteriorating as length of exposure increases. The superior stability of cellulose acetate as compared to cellulose nitrate, is evident. It is also apparent that exposure in Florida is more damaging than exposure in Massachusetts.

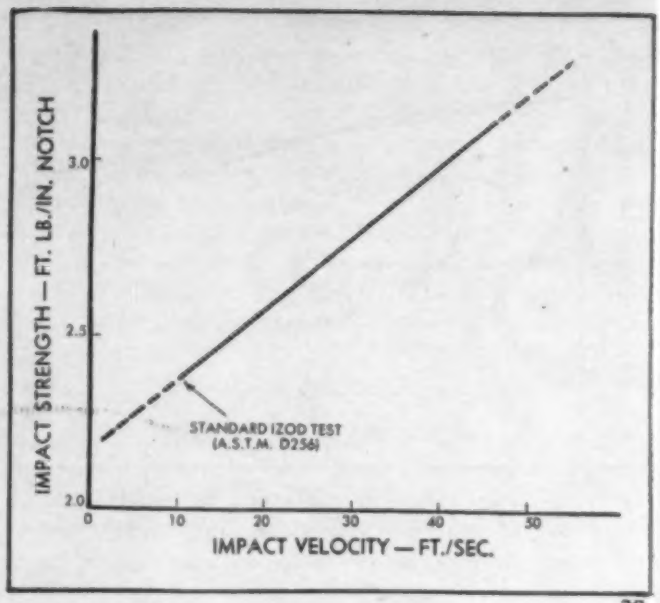
Cyclic tests involving alternate freezing, thawing, humidification, heating, etc., have received much attention in recent years, and several such tests have proved useful as screening procedures for materials intended for military components (25, 33, 38, 62, 67, 73, 95). A.S.T.M. Committee D-20 on Plastics is working on the standardization of such test methods, and it is hoped that quantitative data on the mechanical behavior of various plasties subjected to cyclic conditions will be made available in the near future.

Time scale of action

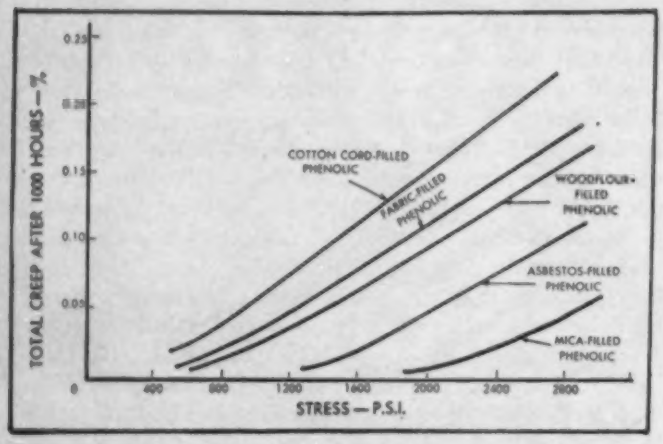
In ordinary laboratory tests of the kind discussed above, a test specimen is subjected to increasing loads until it breaks. The total test period, i.e., the time scale of action of the stresses, is of the order of a few minutes. Evaluation of the mechanical properties of a material under these conditions may not furnish all of the data needed to determine the suitability of the material for an engineering application since mechanical behavior at time scales of differing orders of magnitude may vary considerably. (*Please turn to next page*)



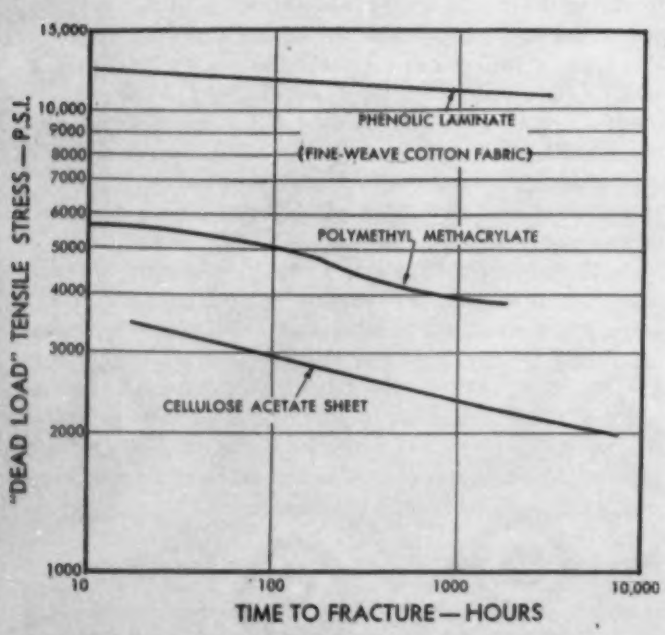
40



39



41



42

39—This graph shows the effect of velocity on the impact strength of molded fabric-filled phenolic. 40—Creep curves for fabric-filled molded phenolic at 25° C. 41—Chart giving one thousand hour creep data at various stress levels for molded phenolic plastics. 42—Curves showing stress vs. time-to-rupture data for several plastics

Organic plastics do not react to stresses in a purely elastic manner as do most metals. Rather, their reac ion combines elastic and viscous types of behavior. Whereas purely elastic responses are largely independent of the time scale of the acting stresses, viscous and viscoelastic responses are highly dependent on the time scale. Such properties as yield strength, tensile strength, modulus of elasticity, elongation, etc., of a viscoelastic plastic will vary as the time scale of the test is varied (6, 7, 9, 10, 13, 23, 29, 30, 32, 44, 46, 48, 51, 52, 55, 58, 65, 66, 80, 83, 93, 98, 101, 118, 120, 121, 122, 125, 130, 141, 142, 143). In general, strength and modulus increase and ductility decreases with the decreasing time scale (i.e., with increasing test speed). Figure 38 shows the way in which the tensile strength of cellulose acetate and polystyrene may vary with testing speeds over the range encountered with common laboratory test machines (100). Similar data could be shown for other materials and other strength properties.

The impact test represents an attempt to measure the behavior of materials when stressed rapidly (i.e., short-time scale), and this test is used widely despite physical limitations with respect to energy measurements (134). In recent years there has arisen a need for impact data at even higher speeds than those attained in the conventional impact test (82, 90, 92, 99, 107, 145, 146, 152, 153). Information of this kind is being obtained for plastics, and valuable quantitative data should be available in the near future. The military importance of such data at ballistic velocities is obvious. Figure 39 shows how the impact strength of a fabric-filled molded phenolic varies over a wide range of impact velocities (135).

If relatively sm ll loads are allowed to act continuously on a material for a long time, failure will eventually occur at stresses far below those required to cause failure in ordinary laboratory strength tests. The material deforms continually, or "creeps," throughout such long-time tests. Hence, if a structure must continuously support loads, even of low magnitude, a knowledge of the behavior of the material under low loads acting for long times is essential. Relatively little information on creeps and long-time-loading properties of plastics has been available until recently. Even now the amount of data available is not as great as is needed. Several valuable publications have pioneered in this field, however, and should be examined for details by those interested (1, 2, 4, 6, 7, 13, 14, 15, 18, *(Please turn to page 160)*

Look at the Speed Nuts [PATENTED]

SPRING-TENSION LOCKING ACTION!

FASTEST THING IN FASTENINGS!

An arched spring lock and an inward thread lock are basic features found only in Speed Nuts. The ingenious design that sets up these two forces accomplishes more than you'd realize unless you checked into it more closely.

Spring steel Speed Nuts have a base which is well arched, and arched prongs that are formed to follow the helical pitch of standard screw threads. As the screw is tightened, the arch is reduced, forcing the prongs deeper into the root of the screw threads. This provides a double spring-tension lock that prevents vibration loosening.

Speed Nuts eliminate the use of lock washers and are 50% to 75% lighter in weight than other self-locking nuts. They are faster to apply and drastically reduce assembly costs. Double your use of Speed Nuts and you will double your assembly savings. Write for literature.

TINNERMAN PRODUCTS, INC.
2048 FULTON ROAD • CLEVELAND 13, OHIO
In Canada . . . Wallace Barnes Co., Ltd., Hamilton, Ontario
In England . . . Simmonds Aerocessories, Ltd., London

The lightest weight self-locking nuts ever produced!

TECHNICAL BRIEFS

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

Engineering

VACUUM FORMING SPEEDS PLASTICS SHEET FABRICATION. E. Greene. Aero Digest *45*, 112, 114, 116 (May 1, 1944). The use of air pressure differentials in the forming of three-dimensional sections from flat sheets of methyl methacrylate resin is described. Sheets of the resin are heated to 250° F. and laid over the top of a vacuum pot, and then a vacuum is applied. When the resin is drawn to the required depth, it touches a contact point which closes the vacuum valve. When irregular shapes are desired, a form is lowered into the depressed warm plastic and the vacuum released; the warm plastic flows back against the form and hardens into the shape of the form. The cooling may be hastened with an air blast. This method produces more optically uniform shapes at less cost than other methods of forming. It is possible to form other types of thermoplastics by this process.

ELECTROPHORETIC FINISHING. E. J. Roehl. Metal Finishing *42*, 313–16 (May 1944). The deposition of materials by the electrophoretic technique is reviewed. The organic materials discussed include rubber, waxes, natural resins, synthetic resins, cellulose, bitumin and lubricants. Directions are given for electrodepositing films of these materials from solutions onto objects. Twenty-two references are given.

Chemistry

PHYSICAL STRUCTURE OF PHENOPLASTS. R. A. Barkhuff, Jr., and T. S. Carswell. Ind. Eng. Chem. *36*, 461–6 (May 1944). The rate of network formation, when cured phenolic films are swollen in acetone, is applied in an investigation of the effect of catalyst concentration, reactant ratios, temperature of initial reaction and temperature of cure on the degree of cure in the final hardened resin. The present concepts of resin structure are reviewed. A modified concept of phenoplast structure which more closely conforms with experimental facts is proposed.

Properties

EFFECT OF MOISTURE ON THE PHYSICAL PROPERTIES OF PAPER-BASE PLASTICS. A. H. Croup. Paper Trade J. *118*, 43–6 (May 18, 1944). Papers impregnated with phenolic resin were conditioned at 9, 22, 32.5, 52.5, 64, 81 and 94.5 percent relative humidity prior to laminating. The papers were bonded into $^1/_8$-in. thick panels at 160° C. and 250 lb./in.^{2} for 12 minutes. Tests were made to determine the tensile properties, flexural properties, water absorption, dimensional stability, specific gravity and resistance to abrasion of the laminates after conditioning at 52 percent relative humidity and 22° C. The results were correlated with the moisture content of the impregnated paper. The moisture content varied from 0.7 to 8 percent. As the moisture content increased 1) the amount of water absorbed increased, 2) the tensile strength and tensile modulus of elasticity decreased, 3) the flexural strength and flexural modulus of elasticity decreased, 4) the Izod impact strength increased, 5) the specific gravity did not change, 6) the dimensional stability decreased, and 7) the abrasion resistance did not change. Additional data indicate that paper-base laminates have their highest tensile strength when conditioned at 50 percent relative humidity. The Izod impact strength and the resistance to abrasion increase with an increase in the relative humidity at which the laminate is conditioned. Three months are required to condition a paper-base laminate completely at the various humidities.

INFLUENCE OF HEAT-TREATMENT ON NOTCHED AND UNNOTCHED IMPACT STRENGTHS OF PAPER AND FABRIC LAMINATES. C. Brinkmann. Kunststoffe *32*, 213–16 (1942). The effect of exposure to temperatures from 110 to 170° C. for various times, on the impact strength of paper and fabric laminates was investigated. At 110° C. the limiting impact strength is reached quickly, but at higher temperature the loss in strength continues over a longer period of time and to lower values. The hardening of the materials as a result of the loss of water is responsible for the decrease in impact strength. Other physical properties probably change also.

THE RHEOMETRY OF ORGANIC GLASSES. I. W. Scheele, M. Alfeis and L. Lahaye. Kolloid-Z. *103*, 1–7 (1943). The flow characteristics of 4 polyvinyl acetate resins at 35 to 110° C. and up to 50 kg./cm.^{2} were determined with a Hoppler consistometer. When the shearing force multiplied by the change in flow was plotted against the reciprocal of the temperature, straight lines were obtained for each degree of polymerization. The lines were not of the same slope.

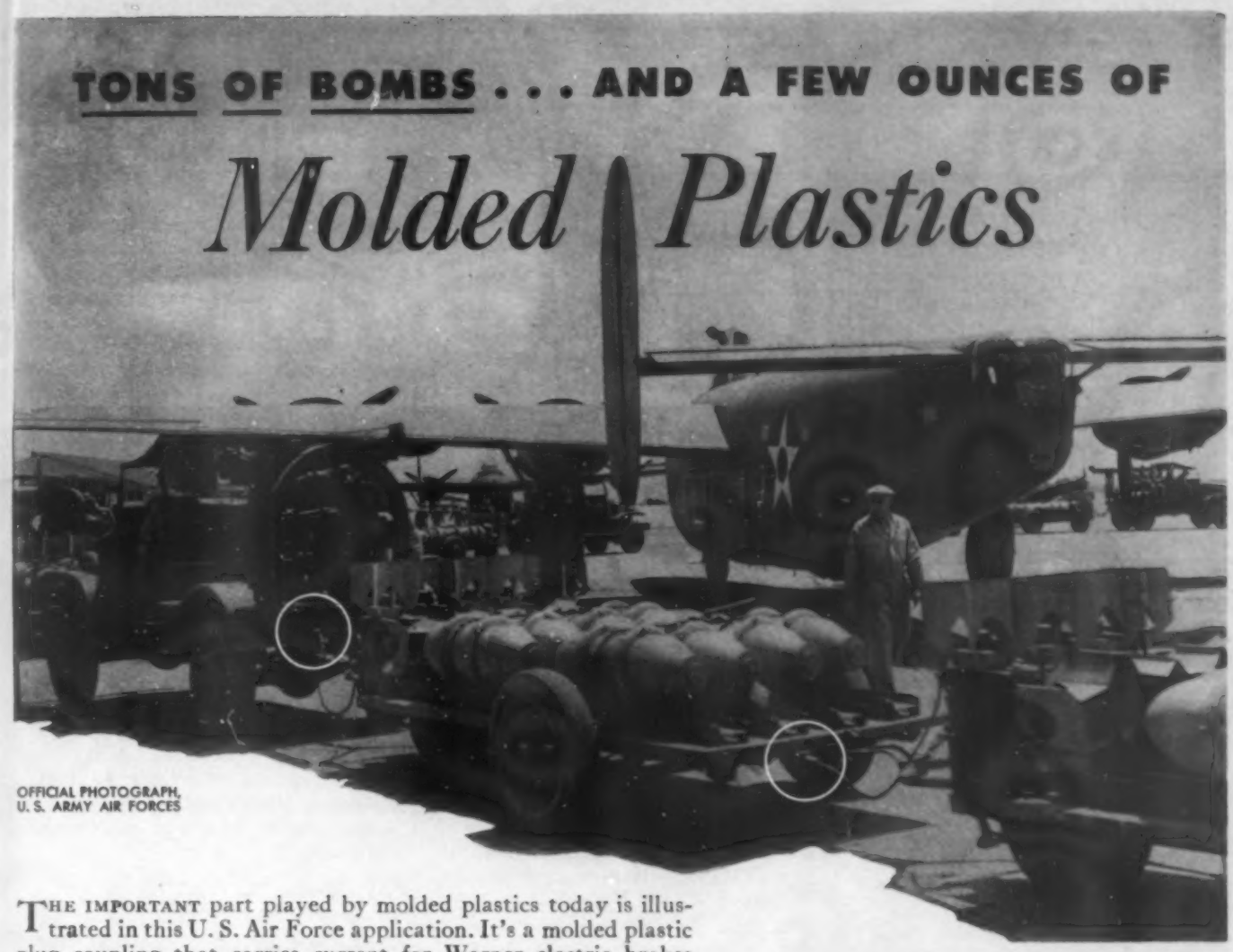
Testing

STRUCTURE AND PHYSICAL PROPERTIES OF PLASTICS. L. W. Turner. Chemistry and Industry *62*, 492–5 (Dec. 25, 1943). Static, dynamic and viscometric methods of studying the deformation processes of plastics are discussed.

DETERMINATION OF WATER VAPOR PERMEABILITY. C. G. Weber. Paper Trade J. *118*, 36–8 (Jan. 20, 1944). Twelve papers and plastic films were tested at the National Bureau of Standards for water vapor permeability by the GFMVT method, two modifications of the GFMVT method, and the TAPPI method. Approximately the same order was established by the various methods. However, there are some important exceptions. The data indicate the importance of using more drastic conditions than those imposed by the TAPPI method when attempting to predict the performance of a material which is to be used under the more severe conditions of humidity and temperature. The results of tests thus far have indicated that the General Foods cabinet can be used for testing at high humidity and temperature with fairly satisfactory results if the following procedure is used: repeated weighings should be made until a net rate of gain is established and light covers should be used to cover the specimens during weighing, thus eliminating the objectionable desiccation step employed in the regular General Foods procedure.

APPARATUS FOR MEASURING GAS TRANSMISSION THROUGH SHEETS AND FILMS. H. R. Todd. Paper Trade J. *118*, 32–5 (Mar. 9, 1944). A volumetric apparatus for measuring the transmission of gases through films is described. The sensitivity of the apparatus is 0.019 cm.^{3} per 100 in.^{2} per 24 hours. The permeability of ethyl cellulose film to air was found to vary with temperature and humidity conditions. In dry air the transmission rate at 36.7° C. was more than double the rate at 1° C. An increase in humidity results in a decrease in the rate of air transmission through ethyl cellulose, whereas the rate of air transmission through regenerated cellulose film increases markedly. Data are also presented on the rate of air transmission through films of cellulose acetate, polyvinylidene chloride, polyvinyl alcohol and glassine. The results obtained with films 0.001 in. thick indicate that lack of uniformity in the films results in excessively high transmission rates. Within the limits of this apparatus the films of polyvinylidene chloride and polyvinyl alcohol appear to be impermeable to air in a seventeen-hour test.

TONS OF BOMBS . . . AND A FEW OUNCES OF *Molded Plastics*



OFFICIAL PHOTOGRAPH,
U. S. ARMY AIR FORCES

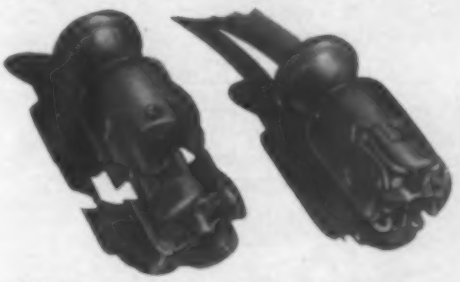
THE IMPORTANT part played by molded plastics today is illustrated in this U. S. Air Force application. It's a molded plastic plug coupling that carries current for Warner electric brakes from tractor to trailer. It weighs only a few ounces, but upon it depends the safe handling of tons of bombs.

These couplings, molded by CMPC for Warner Electric Brake Manufacturing Company, are proving their value in dozens of similar applications. They've a tough job to do . . . and they're doing it . . . day in and day out. Molded of high impact phenolic material, they demonstrate the ability of CMPC to tackle even the toughest problems and come up with the right answer.

This is another example of the importance of choosing the right plastic molder . . . one who can see the job through from design through mold-making, molding, and finishing . . . one who has complete facilities and proven ability to take full and undivided responsibility for the production of a vital part of your product . . . and can time his deliveries in accordance with your production schedules.

Ours is the largest and best equipped custom molding plant in the Middle West, with a national reputation for quality and service. A CMPC Development Engineer will gladly work with you in your planning for postwar products. Write today . . . there's no obligation.

The Warner Coupling Socket with general purpose phenolic insert in metal housing.



The Warner four conductor, plug-in coupling, each component molded of high-impact, macerated canvas phenolic material.

CHICAGO MOLDED PRODUCTS CORPORATION

Precision Plastic Molding

1046 N. Kolmar Ave. Chicago 51, Illinois

COMPRESSION, INJECTION AND TRANSFER MOLDING OF ALL PLASTIC MATERIALS

25 years of Progress and Achievement

PLASTICS DIGEST

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals directly to publishers.

General

PLASTICS: A REVIEW OF PROGRESS IN 1943. E. G. Couzens and V. E. Yarsley. Chemical Age *50*, 75–80 (Jan. 15, 1944). The progress of the plastics industry in the United Kingdom during 1943 is reviewed and compared with that in the United States during the same period. Ninety-eight references are given.

CHEMICALLY TRANSMUTED WOOD. Chem. Eng. News *22*, 726 (May 10, 1944). The treatment of wood with urea and dimethylolurea is described. The compounds are polymerized to resins in situ. This process improves the mechanical properties, fire resistance, machining qualities, dimensional stability and resistance to weathering of wood.

PLYWOOD FOR WAR. T. D. Perry. Chem. Eng. News *22*, 700–5 (May 10, 1944). This article is a review of the salient features in the manufacture and application of plywood. The topics discussed include a brief history of plywood, synthetic resin adhesives, high-density plywood, methods of bonding, molded plywood, temperature control in molding, scarf jointing and applications in aircraft, boats and other war materiél.

Materials

POLYMERIZED ETHYLENE—NEW HYDROCARBON PLASTIC. Chemical Industries *54*, 371 (Mar. 1944). The properties and uses of polythene are discussed. This new hydrocarbon plastic is outstanding for flexibility, toughness and resistance to moisture. It is recommended for use in making gaskets, containers, collapsible tubes, battery parts, flexible tubing, cable covering, coated fabrics and protective coatings.

RESINS FOR PAPER-BASE LAMINATES. N. D. Hanson and P. Wilson. Paper Trade J. *118*, 48–50 (Apr. 13, 1944). Resins used to make paper-base laminates may be classified under the following types: plasticized, fast curing, odorless and chemical-resistant, decorative, beater process and low-pressure. The relative penetration of the resin into the paper stock is an important factor in controlling the grade of product obtained. Data are presented on the relative penetration of 10 resins into 5 grades of paper. Papers for making laminates should have a neutral pH, high wet strength, good fiber formation and good absorbent properties. The most frequently used types of resins are phenolics, ureas and melamines.

APPLICATIONS FOR PULP AND PAPER IN THE PLASTICS INDUSTRY. R. U. Haslanger. Pacific Pulp Paper Ind. *17*, 15–16 (Oct. 1943). Alpha cellulose from wood pulp is used in thermosetting molding compounds because of color requirements. It is used in laminates because it contributes strength and in some instances because of color. Lignin enriched fillers are being investigated because of the plastic properties contributed by the lignin. In the cellulose plastics, alpha cellulose from sulfite pulp is limited to applications where haze and color are secondary considerations. It possesses an advantage in these applications, however, from a cost angle. The total volume of pulp and paper used in 1941, as fillers for the thermosetting resins and as raw material for cellulose nitrate amounted to about 25 million pounds or about 0.1 percent of the pulp production of the country.

Molding and fabricating

INJECTION MOLDING WITH POLYAMIDES. H. Beck and F. Schaupp Kunststoffe *32*, 205–9 (1942). The hardness, heat distortion, water absorption and electrical properties of 5 polyamides (Igamids) are given. The injection molding temperatures range from 145 to 200° C. Several designs of suitable equipment for injection molding are described.

FACTORS IN MOLDING CELLULOSE DERIVATIVES. W. O. Bracken and F. E. Piech. Ind. Eng. Chem. *36*, 452–6 (May 1944). Strain in translucent injection-molded cellulose acetate and in sheet cellulose acetate and ethyl cellulose is related to the temperature of forming, mold temperature, rate of filling injection mold and solving content when sheet stock is pressed. The strain patterns were observed by placing the molded pieces between crossed Polaroid films. High temperature and pressures produce pieces of minimum strain pattern, closest mold reproduction and heaviest weight. Low rate of filling mold aids in forming bubble-free pieces. Side gating is more effective than corner gating in producing pieces relatively free of strain. Solvent content in block prior to baking, baking temperature and cooling pressure are critical factors in achieving strain-free cellulose acetate sheet stock.

Applications

UREA-FORMALDEHYDE RESINS IN THE BEATER. R. J. Myers and V. N. Morin. Paper Trade J. *117*, 27–32 (Dec. 2, 1943). A urea-formaldehyde resin suitable as a beater-size is described. The resin is furnished as a light straw-colored solution containing 50 percent solids and with a pH of 7 to 8. The solution can be diluted with water at temperatures above 50° F. Results of tests indicate that: 1) maximum wet strength is obtained at pH 4 to 5, 2) aluminum sulfate is superior to free acid as a catalyst, 3) the resin increases the dry and wet tensile strength, 4) the resin has little effect on the tearing resistance, 5) resin retention is increased at low pH and 6) the wet strength values are proportional to the resin content. Both time and temperature are important in curing the resin; the cure continues for about 8 days after the paper comes from the machine drier. The use of common addition agents such as rosin and starch does not appear to have any effect on the wet strength developed by this new resin. Stability on aging is good. The results of experiments on various types of pulp and on beating are also reported.

ADVANTAGES OF BONDED PAPER SHEETS AS AIRCRAFT MATERIAL. F. M. Reck. Aero Digest *44*, 124, 126, 129, 132 (Mar. 15, 1944). Laminated plastics made of high-strength paper, phenolic resin and wooden cores are described.

Coatings

PHENOLIC RESIN BAKING FINISHES FOR PROTECTION AGAINST CORROSION. R. L. Norum. Chemical Industries *54*, 524–8 (Apr. 1944). The properties, methods of applying and uses of phenolic resin baking finishes are reviewed. Information is given on cleaning the various types of surfaces to be coated, methods of coating and the types of baking.

COATINGS FOR STEEL CARTRIDGE CASES. R. A. Brenneck and R. L. Norum. Metal Finishing *42*, 245–7 (Apr. 1944). Baked phenol-formaldehyde resins are recommended for use on steel cartridge cases. These finishes meet the requirements of U. S. Army Ordnance Specification AXS-736. The procedures for cleaning the steel cases, applying the resin and baking are explained in detail.

TERNARY SOLVENTS FOR ZEIN. C. D. Evans and R. H. Manley. Ind. Eng. Chem. *36*, 408–10 (May 1944). The critical peptization temperature diagrams for zein in ternary solvents are presented. The solvents include formaldehyde, methyl alcohol, water, ethyl alcohol, isopropyl alcohol, acetaldehyde, butyraldehyde, dioxane, nitromethane, acetonyl acetone, diacetone alcohol, methyl cellosolve, acetone, rosin, methyl acetate, toluene and benzene.

MATCH THE RESIN TO ITS ROLE

Whatever end products you may manufacture . . . whatever plastics you may mold or process, you need a resin that has the combination of properties and characteristics demanded by the materials with which it is combined.

Among the various Cardolite resins are useful rubber-like polymers, friction-fortifying dusts, liquid binding resins, and resins for molding compounds. These products are used in the manufacture of electrical insulation, brake lining and similar friction elements, and in the fabrication of laminated paper and cloth. The characteristics of Cardolite resins indicate applications in the production of plywood and, through admixture, improvement of the physical properties of other resins, especially, the impact strength of other phenol-aldehydes.

Get in touch with the Irvington technical staff for assistance in your product development work. For specified applications, laboratory samples will be furnished on request. In either case, please address Dept. 146.

***The Source of Cardolite Resins** is the dark, mahogany-colored liquid extracted from the shell structure of the cashew nut. This liquid is a high molecular weight, unsaturated material with phenolic characteristics. Refinement and treatment by aldehyde condensation and acid polymerization, yields the highly versatile family of Cardolite resins.*

IRVINGTON VARNISH & INSULATOR COMPANY

IRVINGTON 11, N. J.

RESINS · EXTENDERS · PLASTICIZERS · EXTRUDED PLASTIC TUBING

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

MOLDING. F. H. Shaw (to Shaw Insulator Co.). U. S. 2,344,176, March 14. A molding device for injection molding of thermosetting resins.

VINYLIDENE CHLORIDE. E. H. Harder (to Dow Chemical Co.). U. S. 2,344,511, March 21. An article consisting of crystalline vinylidene chloride polymer is heated to a temperature in the range between its softening point and 50° below this point, while applying tension short of the breaking load until permanent elongation is attained.

PLYWOOD PANELS. M. Pasquier (to M and M Woodworking Co.). U. S. 2,344,722, March 21. Plywood panels are spliced by forming scarfed surfaces on each panel, applying thermosetting resin adhesive, and curing the resin with heat.

MOLDING COMPOSITION. K. E. Ripper (to American Cyanamid Co.). U. S. 2,344,733, March 21. A heat-setting molding composition comprising small particles of glass cloth impregnated with a polymerizable aminoplastic resin.

POLYACRYLIC ESTERS. W. S. Johnson (to Rohm and Haas Co.). U. S. 2,344,918, March 21. Permanently plastic polymers of acrylic acids, esters and nitriles are prepared by masticating the polymeric materials with sulfur and an ammonium dithiocarbamate at temperatures of 100–160° C.

KNITTED ELASTIC FABRIC. S. C. Lilley and E. E. Foster (to United Elastic Corp.). U. S. 2,345,055, March 28. A knitted fabric comprising elastic strands and inelastic strands, the latter being composed of an artificial resin which is heat shrinkable and which serve as gripping strands.

PLASTIC MOLDING. F. Grundel (to Alien Property Custodian). U. S. 2,345,112, March 28. Raised patterns on the surface of plastic articles are formed by using a porous patterned form, to part of which is applied a layer of the material, making the area not covered impervious to air, and subjecting to suction the side of the form opposite to that on which the pattern is provided, whereby the layer of plastic is drawn against the surface.

ARTIFICIAL TEETH. H. M. Thornton (to Dentists' Supply Co. of New York). U. S. 2,345,305, March 28. A device for injection molding artificial teeth from thermoplastic resins.

INSERT. L. H. Amrine (to Imperial Molded Products Corp.). U. S. 2,345,371, March 28. A method for molding a door handle or similar article from plastic material in which is embedded an insert of another material.

IMPREGNATED FABRIC. W. F. Scholze, Jr. (to Robertson Bleachery and Dye Works, Inc.). U. S. 2,345,541, March 28. Strands of textile material are impregnated with a urea-formaldehyde resin and subjected to temperatures sufficient for the curing of the resin.

MELAMINE-FORMALDEHYDE RESIN. H. P. Wohnsiedler and W. M. Thomas (to American Cyanamid Co.). U. S. 2,345,543, March 28. A colloidal aqueous solution of a partially polymerized positively charged melamine-formaldehyde resin having a pH of 0.5 to 3.5 in 15 percent solution.

CAULKING COMPOUND. W. B. Lerch, C. H. Mathis and E. J. Gatchell (to Phillips Petroleum Co.). U. S. 2,345,611, April 4. Water formations in wells are plugged by introducing a liquid solution of urea or thiourea formaldehyde resin containing a catalyst.

EMBOSSING. J. H. Reilly (to Dow Chemical Co.). U. S. 2,345,629, April 4. The surface of a body composed of crystalline polymerized vinylidene chloride is embossed by pressing with an embossing die at a temperature above 50° C.

VINYL CHLORIDE POLYMER. A. W. Downes (to Carbide and Carbon Chemicals Corp.). U. S. 2,345,659, April 4. A vinyl resin is polymerized at a rate of polymerization of 1.6 percent vinyl monomer per hour which comprises polymerizing vinyl chloride while mixing therewith less than 0.07 percent of hydrogen peroxide.

VINYL POLYMERS. A. W. Downes and J. R. Kernan (to Carbide and Carbon Chemicals Corp.). U. S. 2,345,660, April 4. Vinyl chloride acetate copolymer is prepared at a rate of polymerization in excess of 2.76 percent monomers polymerized per hour, by mixing at 30 to 80° C. with a concentration of 0.05 percent of hydrogen peroxide.

POLYISOBUTYLENE. L. B. Turner (to Jasco, Inc.). U. S. 2,345,717, April 4. Polyisobutylene having molecular weights of 50,000 to 350,000 is mixed with paraffin wax.

PICTURE FRAME. H. Weil, Jr. (to Celomat Corp.). U. S. 2,345,719, April 4. A foldable picture frame composed of plastic material.

MOLDING. R. T. Coffman (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,345,917, April 4. A device for injection molding of plastic material.

FURANE RESINS. E. F. Fiedler and G. Holmberg (to General Electric Co.). U. S. 2,345,966, April 4. A polymerizable resinous composition of furfuryl alcohol and mixtures of furfuryl alcohol and furfural and as catalyst therefor, a small amount of a salt of a strong mineral acid and an amine or an amide.

OPTICAL INSTRUMENT. A. H. Bennett and R. S. Estey (to American Optical Co.). U. S. 2,346,002, April 4. An optical instrument having a lens and a clear body of plastic material having a different index of refraction.

METHACRYLATE POLYMERS. R. E. Leary (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,346,036, April 4. An article comprising 2 pieces of cast methacrylate polymer cemented with monomeric methacrylic acid.

COATINGS. E. M. Bright (to Plastic Veneering, Inc.). U. S. 2,346,101, April 4. A dip coating is cured by drying the freshly dipped article in warm air at low pressure.

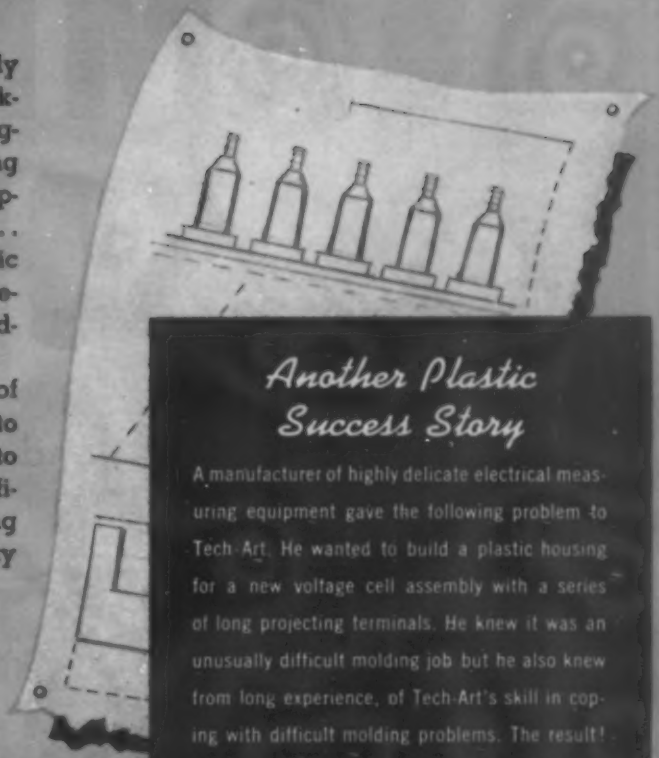
METHYL METHACRYLATE PLASTIC. W. S. Johnson (to Rohm and Haas Co.). U. S. 2,346,107, April 4. Methacrylic resin is freed of elastic properties which cause distortion by heat by subjecting to milling on hot rolls in the presence of barium or potassium phenanthrene-2-sulfonate, sodium m-nitro benzene sulfonate, sodium 2,4-dinitro alpha naphthol 7-sulfonate, thiosalicylic acid, thiourea, ethyl crotonate, maleic anhydride, phthalic anhydride, acetamide, alpha mono bromo isovaleryl urea, or methallyl chloride.

See Your Ideas Molded...in PLASTICS

When you see and touch your idea, which has suddenly become through the wizardry of plastics, a tangible, workable and efficient reality, you will have come to recognize modern plastics as a highly developed, exacting science. For no plastic product, for example, can be properly developed without being soundly engineered first... without the greatest precision in the building of plastic molds... without the careful selection of the right materials to use... without pains and care in the actual molding itself.

At Tech-Art all of these factors of technical skill, of experience and craftsmanship together with facilities to produce every kind of molded plastic piece combine to make plastic success stories out of some of the most difficult and problematical assignments. If you are facing such a plastic enigma, a letter dropped to us today may save you time and money tomorrow.

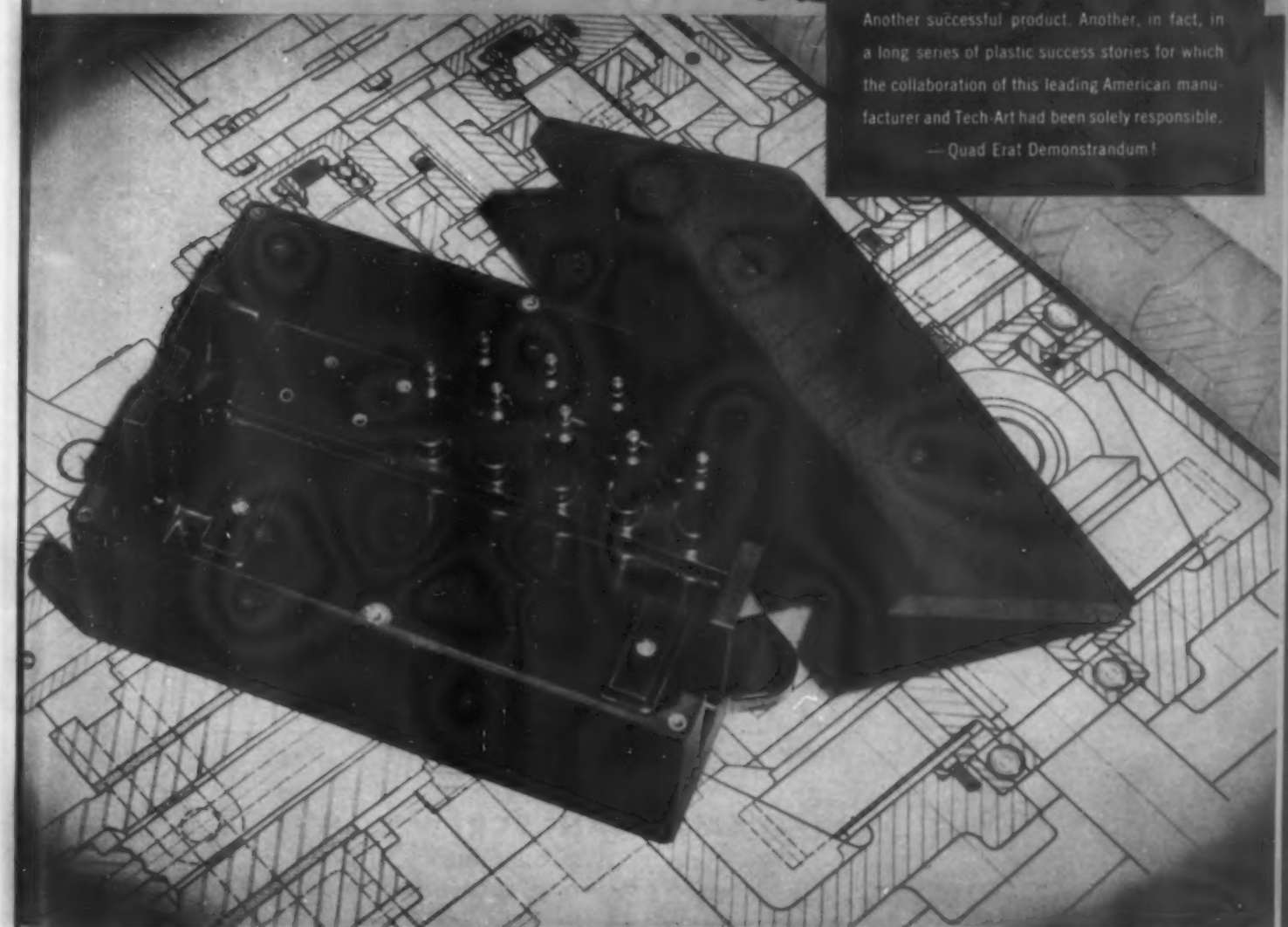
TECHNICAL NOTES: *The materials used in this molded piece were carefully selected for their electrical properties. The major problem involved was a particularly long flow of materials into deep narrow channels to provide a series of ten bosses to house as many closely assembled electrical terminals.*



Another Plastic Success Story

A manufacturer of highly delicate electrical measuring equipment gave the following problem to Tech-Art. He wanted to build a plastic housing for a new voltage cell assembly with a series of long projecting terminals. He knew it was an unusually difficult molding job but he also knew from long experience, of Tech-Art's skill in coping with difficult molding problems. The result? Another successful product. Another, in fact, in a long series of plastic success stories for which the collaboration of this leading American manufacturer and Tech-Art had been solely responsible.

— Quad Erat Demonstrandum!



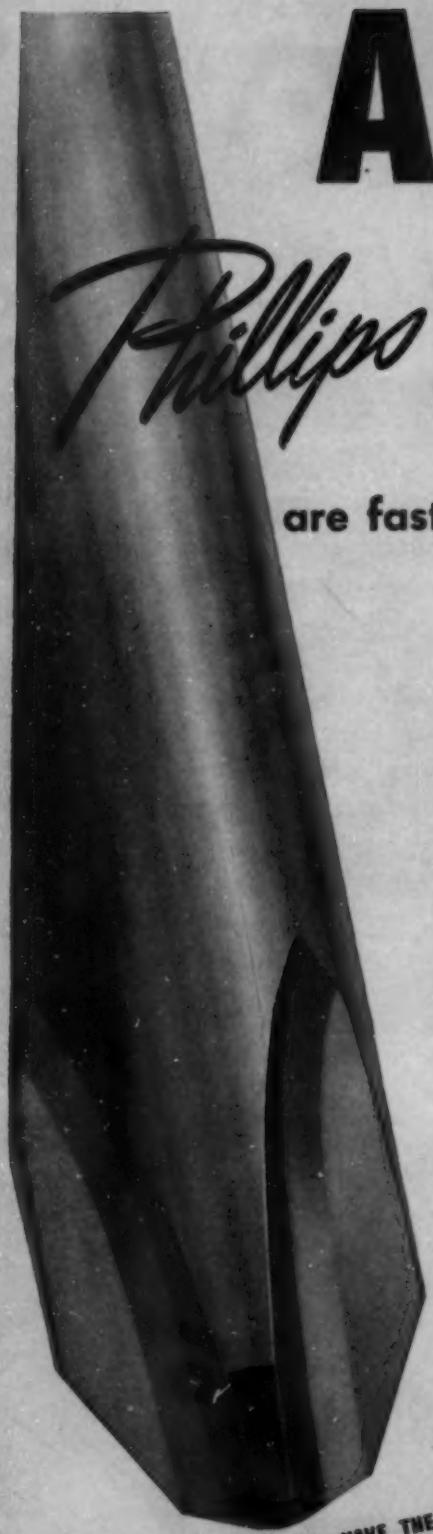
TECH-ART PLASTICS COMPANY

36th Ave. and 41st Street • LONG ISLAND CITY, N. Y. • Tel. AStoria 8-6050-1

SUCCESSORS TO BOONTON RUBBER MANUFACTURING COMPANY

AMERICAN Phillips SCREWS

are faster . . . and cost less to use . . . because they're



ONLY PHILLIPS SCREWS HAVE THE ENGINEERED TAPERED RECESS

Fumble-Proof

The American Phillips *Recessed Head* fits firmly onto the 4-winged driver . . . which can't slip out or twist out in any direction. So the faster methods of driving (spiral and power) are safe to use. No fumbling, no dropping of screws. *Time is saved.*

Self-Aligning

The American Phillips Screw and Driver form a single unit that is automatically self-aligning. No fussing around to get a straight start, no fatiguing nerve strain which leads to poor work that must be done over. Here again . . . *time is saved.*

Straight-Driving

The American Phillips Screw and Driver *stay in alignment* under the stress of the driving operation. So the screw can't be driven any way but straight. No burred heads, no scarred work. Screw head is set up tight and flush *every time. Total time savings:* UP TO 50% . . . not to mention savings of screws and materials.

AMERICAN SCREW COMPANY

PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois St. • *Detroit 2:* 502 Stephenson Building

Put the Screws on the enemy . . . BUY BONDS!

..TO SEE OPPORTUNITIES IN AMOS MOLDED *Plastics*

▶ **The plastic telescope** you see here was molded by Amos for one of our customers to sell—a company with sales and product problems comparable to yours, perhaps.

▶ **Your products are different,** of course. You don't expect to market a plastic telescope. And you certainly don't need one to see the advantages that molded plastics offer you—to improve your products, or parts of them—in quality, performance and sales appeal.

▶ **All you need** is a competent molder working with you as Amos does—to take full advantage of your opportunities. We cooperate with you in every way—with engineering assistance and complete facilities for the design and production of anything that should be molded by the fast, efficient Amos injection process. Amos will serve you well. Our experience and reputation are your assurance.

As an aid to your thinking on molded plastics, write for our booklet—"Will You Use Plastics?" It's full of helpful information and technical data—free and without obligation.

Amos
MOLDED PLASTICS...

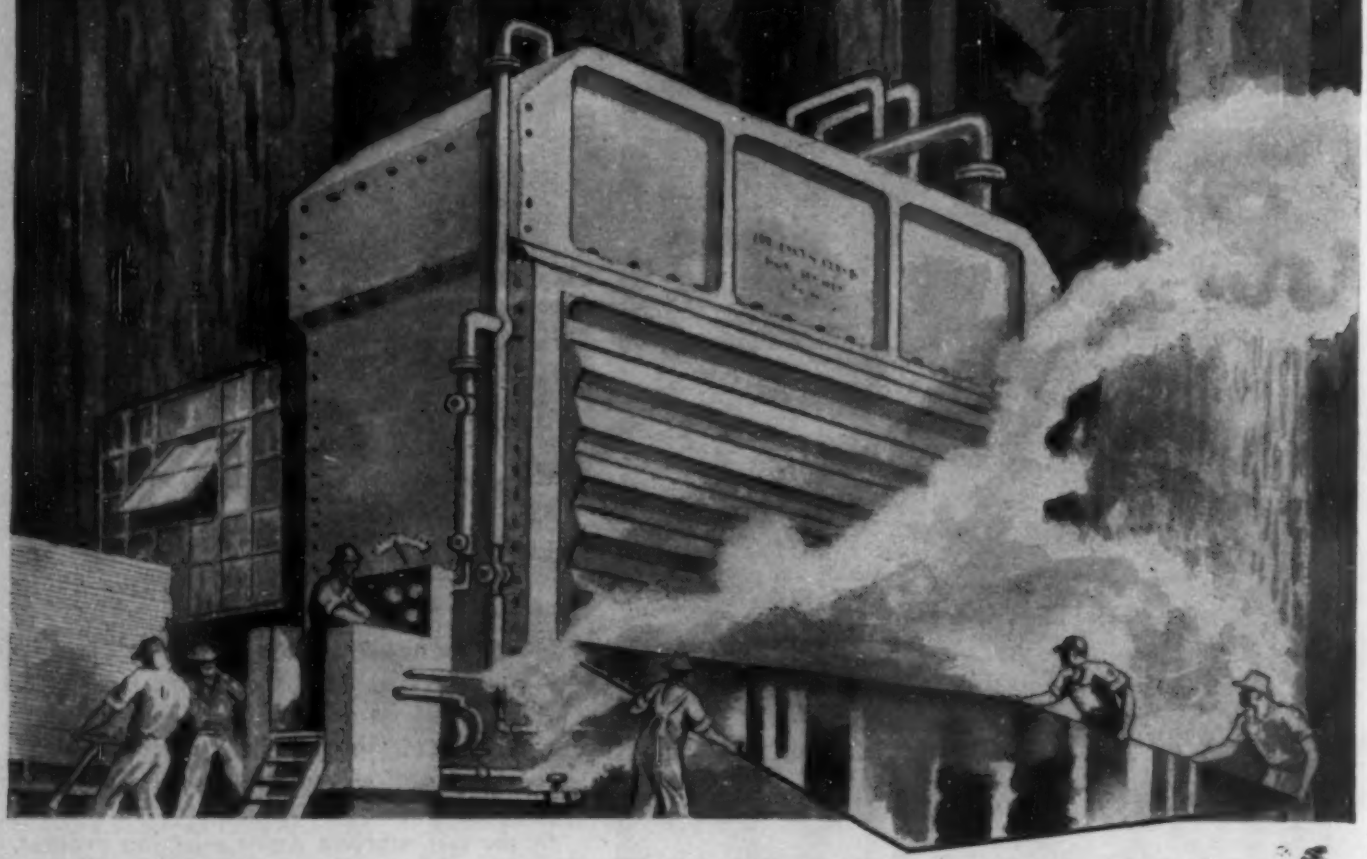
Custom Molders of Parts and Products by the Injection Process

AMOS MOLDED PLASTICS, EDINBURGH, INDIANA - Division of Amos-Thompson Corporation

From the Douglas Fir Forests and the Plastics Industry comes a *NEW* tested material

INDERON

THE STABILIZED STRUCTURAL PRODUCT



What is INDERON?

INDERON is a new material, combining the advantages of two other proven materials —fir plywood and plastics. It is composed of three basic ingredients: strong, durable Douglas fir veneers, a plastic-impregnated fibrous film, and an internal adhesive of thermosetting resin. INDERON is neither a plywood nor a plastic. It is, in effect, an alloy which possesses the qualities of a true plastic at a cost comparable to finished plywood. It is manufactured in modern West Coast plywood plants, where Douglas fir veneers, phenolic adhesives and resin-impregnated paper are chemically united in high-heat, high-pressure presses.

What are the advantages of INDERON?

Because INDERON combines the best qualities of both plastic and plywood, it is available in larger sheets and can be produced cheaper than an ordinary plastic. Yet it is permanently insoluble and affords a marked resistance to chemical or mechanical destructive elements. In strength value it compares favorably with aluminum. It is dimensionally stable, inexpensive, easy to work, and requires no surface protection. In peacetime application it will be available in permanent colors, designs and patterns— all of which will be an integral part of the product itself!

How can you plan to use INDERON?

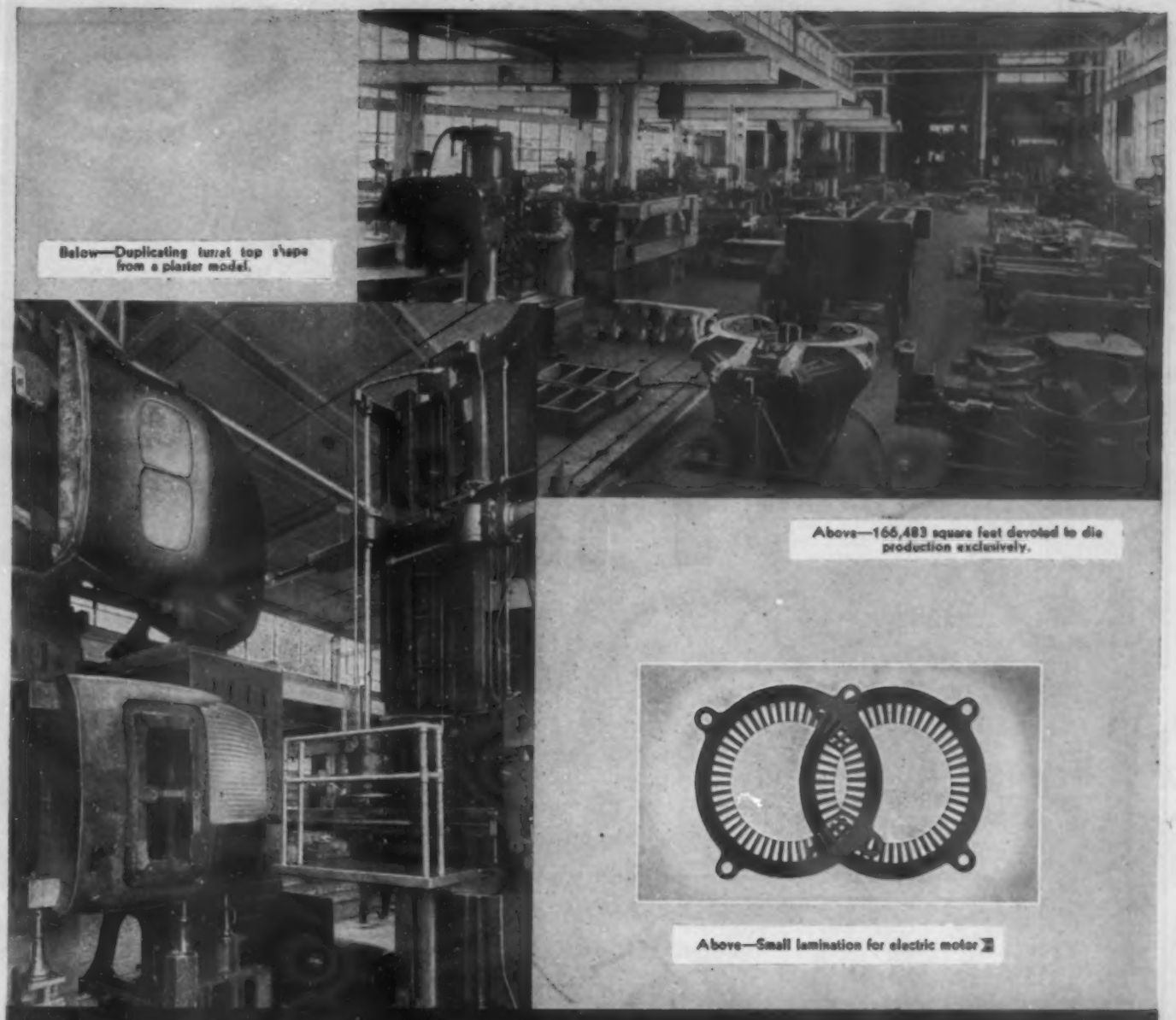
At present, INDERON is available only for Army-Navy uses. When it is no longer so urgently needed for war, INDERON will serve a wide range of uses in many industries. For example: INDERON is ideal for marine application. It will resist salt water, terrific strains, impact blows, abrasion, corrosive and toxic fumes. In the building field, INDERON will serve as roof, walls, floors and built-ins for tomorrow's homes. Furniture will be made both strong and beautiful with this new structural product. It will be applied to special packaging, to prefabrication, to many another field. Learn more about INDERON—

Write NOW!

Buffelen Lumber & Mfg. Co.
Tacoma 1, Washington
Washington Veneer Co.
Olympia, Washington
manufacturers

INDERON

THE *Stabilized* STRUCTURAL PRODUCT



Below—Duplicating turret top shape from a plaster model.

Above—166,483 square feet devoted to die production exclusively.

Above—Small lamination for electric motor

ALLIED PRODUCES DIES FOR THE *"Stamp of Approval"*

Buy More War Bonds

Long before the war, precision dies produced by Allied Products Corporation enjoyed the automotive industry's "stamp of approval". Today, Allied is engaged 100% in the production of dies and parts for manufacturers of war materiel. But the moment the shooting stops—or before, if the war production board desires—Allied will be ready to start producing again for the makers of cars and trucks and their suppliers.

Dies of all types and sizes up to the largest, including those where extreme accuracy is required, are an Allied specialty. Modern equipment from Swiss Jig Borers to a 23-Foot Ingersoll Milling Machine, speeds the operations of experienced craftsmen. Additional equipment, including electric cranes with a handling capacity of 50 tons, expedites the flow of finished dies and parts. Bring your stamping die problems to Allied for sure solution!

"IT'S AN ALLIED PRODUCT!" . . . Allied Products Corporation and its divisions, Richard Brothers and Victor-Peninsular, in Detroit and Hillsdale Michigan, also make: The original, patented R-B Interchangeable Punch and Die; plastic molds; jigs and fixtures; precision hardened and ground parts; and other special products.

ALLIED PRODUCTS CORPORATION

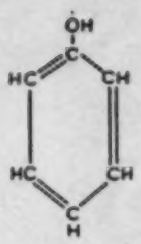
Executive Offices: 4646 Lawton Ave., Detroit 8, Mich.

All four plants have now added a star to their Army-Navy "E" pennants

KOPPERS

Natural Phenol

entirely of coal tar origin



Koppers' entire production of phenol is derived from the natural tar acids present in coal tar from by-product coke ovens. Because it is associated with cresols and xylenols, as it occurs in coal tar, its composition can be adjusted to contain varying amounts of these other tar acids for processes which require blended acids. Koppers Phenol is available not only with melting points of 39°C. and 40°C., but also as 90% Phenol with about 10% ortho cresol, and as 82% Phenol with 2% to 3% meta-para cresol and the remainder ortho cresol. All blends of phenol and cresol required by industry are offered by Koppers. Samples gladly furnished upon request.—Koppers Company, Tar and Chemical Division, Pittsburgh 19, Pennsylvania.

KOPPERS

The Industry that serves all industry

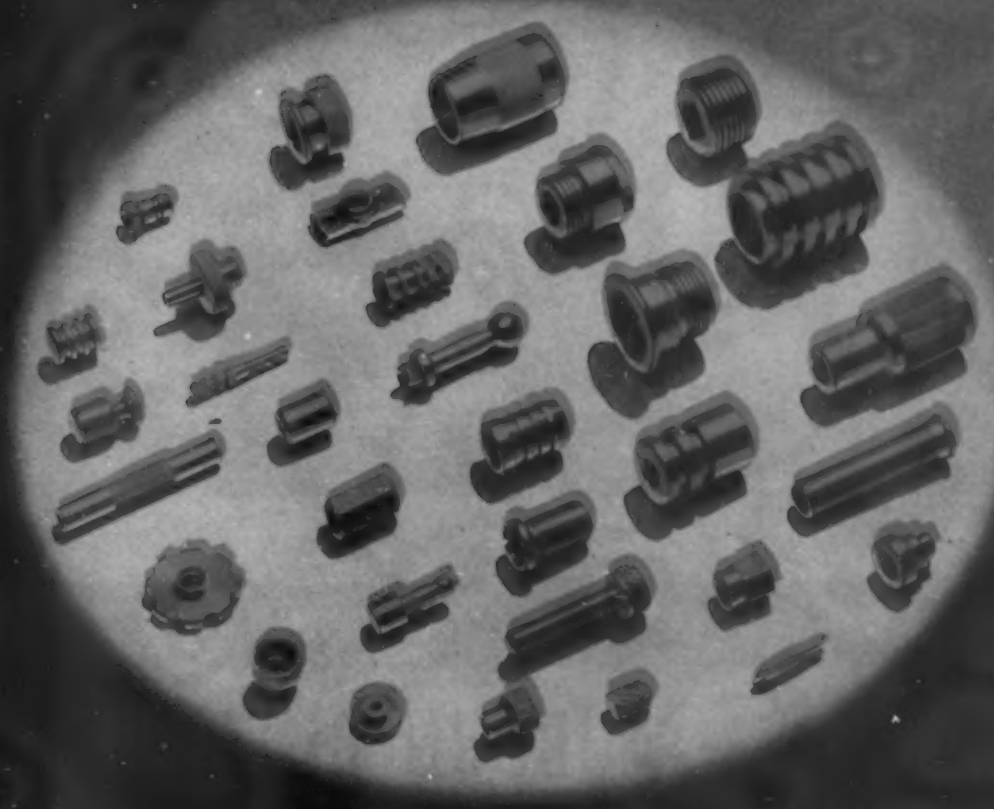
In The Spotlight . . .

When the spotlight falls on products manufactured by "Chicago Screw", you are looking at the finest there is. Outstanding producers of precision screw machine products for more than 72 years has resulted in an organization that is rich in experience, engineering ability and modern production facilities.

Whether your problem involves plastics, brass or hardened and ground steel screw machine products, our skilled technicians will give you what you want—when you want it!

ARMY E NAVY

THE CHICAGO SCREW CO.
1026 So. Homan Ave. · Chicago 24, Ill.



"UNDER THIS GLASS PASS ONLY *Perfect Molded Parts*"

Every Auburn molded part is subjected to a critical inspection, though not always, as here, under high magnification. *But* where such a minute inspection means the difference between continuous and interrupted assembly operations in your plant you can be sure it will get that inspection.

It is knowledge of where to put the emphasis that makes Auburn molded service so valuable. You can be sure that your requirements in molded plastics will get this same individual study. Every step in the production of your parts, from the engineering department to the shipping room, gets the attention it requires so that molded parts will meet your specifications.

If you are considering the use of plastics in your products, consult Auburn. Our engineers can provide the facts on which to make your decision.

AUBURN

PLASTIC PRODUCTS AND SERVICES

Custom Molding by Compression or Transfer
★ ★ ★
Injection Molding of Thermoplastic Materials
★ ★ ★
Extruded Vinyl or Acetate Tubes and Shapes
★ ★ ★
Cellulose Nitrate Rods, Sheets, Molded Parts
★ ★ ★
Mold Engineering and Complete Mold Shop

AUBURN BUTTON WORKS

INCORPORATED

FOUNDED IN 1876 AUBURN, N. Y.

An Open Letter and Invitation to

Tool and Die Makers Who Have Shop Problems

- Several years ago Kearney & Trecker began helping tool and die makers with their shop problems whenever they'd write in asking as to the best method of producing a particular tool or die. These requests for help included the making of plastic molds — forging, die casting, stamping, and drawing dies. In fact, they covered the whole tool and die field.

- In many cases our Model D Rotary Head Miller would handle the job to perfection — in other instances, after looking at the blueprints, we'd recommend some other method of producing the tool or die that was troubling them.

- Because of the extreme pressure which all of us were working under at that time, we didn't publicize the fact that such service was available. BUT . . . now we have set up facilities in our Tool and Die Department which will enable us to give you *prompt* advice without obligation, as to the fastest, cheapest way to do the job.

- If our Model D Rotary Head Miller is, in our judgment, the best bet for producing it — we'll tell you. In fact, we'll even make the job for you at a *very nominal cost* here in our own Tool and Die Department. What's more, we'd welcome having one of your men come to the plant to watch us make it.

- *If,* on the other hand, we feel that there's a better method of producing the tool or die — we'll return your blueprints with our recommendations. Fair enough?

If you're interested — write Tool and Die Division, Kearney & Trecker Products Corp., Milwaukee 14, Wis.

Kearney & Trecker Products
CORPORATION

IT'S LIKE GIVING YOUR ASSEMBLY LINE A SHOT IN THE ARM

TO SWITCH TO THE SCREWS WITH THE ENGINEERED RECESS THAT SPEEDS UP ASSEMBLY AS

MUCH AS 50%

IT'S PHILLIPS

Manufacturers in every industry can tell you that switching to Phillips Recessed Head Screws acts like a tonic to assembly lines.

To start with, you get faster – *much faster* – screw driving. Comparisons made in scores of plants prove that Phillips Screws step up fastening speed as much as 50%.

Next, Phillips Recessed Head Screws save precious man hours. The scientifically Engineered Recess utilizes the worker's full turning power and skill. Time and muscle are not wasted on wobbly starts, slantwise drives and dangerous driver skids – nor on correcting sloppy work.

Finally, with all this increased speed, you get vastly better workmanship. Phillips Recessed Head Screws make driving so simple, so steady that the most inexperienced operator soon becomes master of the trickiest fastening jobs!

If these are the kind of results you'd like, but aren't getting from slotted and other type screws, you owe it to yourself and to your workers to switch to Phillips – the screws with the *Scientifically Engineered Recess.* They cost *less to use* . . . because they help you *produce much more.* Any one of the 23 manufacturers below will enable you to prove it in your own plant.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS · MACHINE SCREWS · SELF-TAPPING SCREWS · STOVE BOLTS

TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

Faster Starting: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

Faster Driving: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

Easier Driving: Turning power is fully utilized. Workers maintain speed without tiring.

Better Fastening: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.

IDENTIFY IT!

Center corners of Phillips Recess are rounded . . . NOT square.

Bottom of Phillips Recess is nearly flat . . . NOT tapered to a sharp point.

23 SOURCES

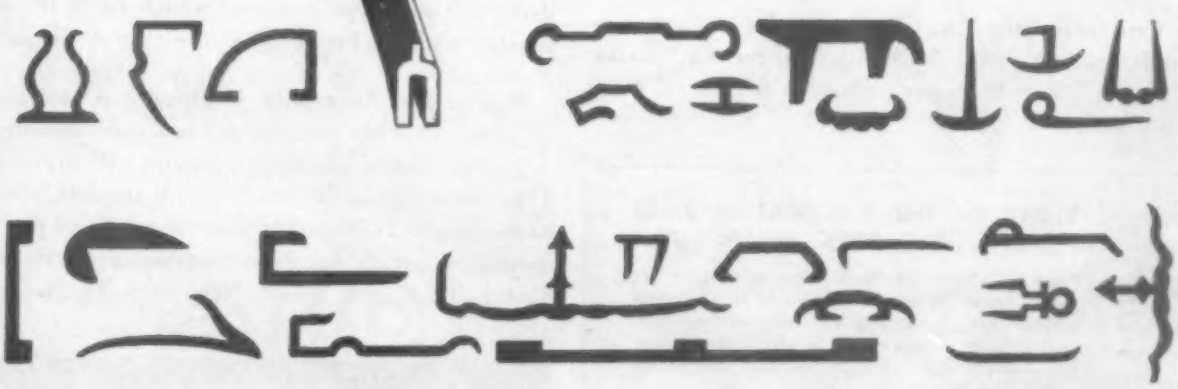
American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Wolverine Bolt Co., Detroit, Mich.

PLASTEX
Stock Shapes Available NOW!

The extruded plastic shapes illustrated on this page are made from stock dies available for immediate production.

These shapes readily lend themselves to many industrial, architectural, decorative and functional applications . . . glass edgings, table and counter edgings, finishing strips, decorative moldings, card holders and dozens of other uses. They will serve to make many products more useful, durable, attractive and economical.

In every Plastex extrusion you are assured of uniform high quality, close tolerances and correct materials, as well as a full range of color. Write today for samples and prices.

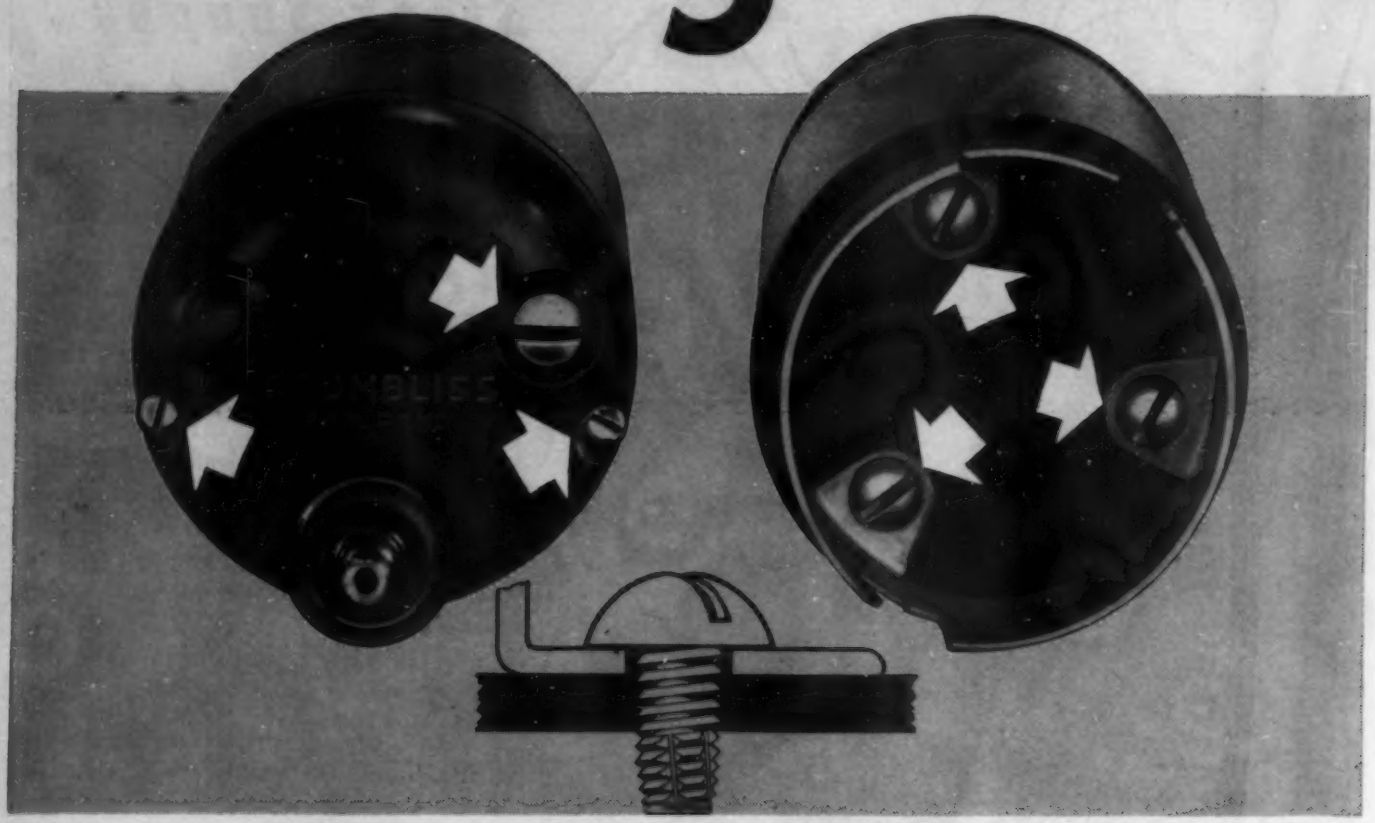


If stock shapes will not meet your requirements, Plastex engineers will be glad to work with you in producing special dies.

• PLASTEX •

THE PLASTEX CORP. • COLUMBUS, OHIO

The Simpler Fastening Method scores another 3-way Saving



Plastic assembly with P-K Self-tapping Screws saves tapping time . . . saves tap expense . . . ends breakage.

The Crumbliss Mfg. Co., Chicago, makers of automotive high tension coils, chalks up a three-way saving every time a P-K Self-tapping Screw is driven on their assembly line.

"We chose P-K Self-tapping Screws because they save time (up to 50% over assembly with machine screws), and eliminate problems of tap maintenance and replacement," writes Crumbliss. "We just drill the holes and drive in your Type F screws which cut a thread in the plastic, without breakage of the thin-shell parts."

Ask a P-K Assembly Engineer to point out *your* opportunities for savings. He is a specialist in all types of plastic and metal fastenings, and will show you where P-K Self-tapping Screws will end trouble, speed work, save money. He'll call at your request – or you can mail assembly details for recommendations. Parker-Kalon Corp., 208 Varick Street, New York 14, N. Y.

THREE OF THE P-K SCREWS THAT SPEED UP PLASTIC ASSEMBLIES

Type "Z" Thread-Forming Screws — All purpose, *form* their own threads in the material. For fastening to cellulose acetate and nitrate compounds, methyl methacrylate resins, polystyrenes, laminated phenolics, and metal.

Type "F" Thread Cutting Screws — Expressly developed for use in crumbly and friable materials, such as phenolic and urea base compounds, cold mold compositions, and hard rubber. Also for metals. *Cuts* a thread like a tap.

Type "U" — For Permanent Fastenings — For use in most plastics and metals. Hammered or otherwise forced into the material, it forms its own thread. Cannot be removed.

PARKER-KALON

Quality-Controlled

SELF-TAPPING SCREWS

Attractively Finished WITH THE HELP OF LEA METHODS *and* MATERIALS

This isn't war work, as so much in plastics and metals is today. But it does involve the production of articles needed to help maintain, so far as possible, our normal business contacts, one of which is to display available merchandise attractively. These Shoe and Hosiery Stands, made of LUCITE or PLEXIGLAS by Transposter Service of Boston, contribute their share.

But note how dainty and delicate they are. It takes real skill, the proper methods and proper materials to finish these stands without damaging them. LEA Finishing Specialists helped to devise proper finishing methods and are providing the materials as needed.

This finishing service to Transposter is typical of what LEA can do and is doing for the plastic industry as a whole. Perhaps you have a finishing problem that is bothering you. Why not call in a LEA specialist?

THE LEA MANUFACTURING CO.

Waterbury 86, Conn.

Burring, Buffing and Polishing . . . Manufacturers and Specialists in the Development of Production Methods and Compositions

7-1

NEW MACHINERY AND EQUIPMENT

★ A NEW MODEL OF THE "HY-Mac" extreme pressure intensifier—the hydraulic test bench model T-113—has been announced by Hydraulic Machinery, Inc., Dearborn, Mich. This model includes special high unit pressure connections throughout, a specially balanced high-pressure plunger and packless plunger sealing, extreme pressure inlet check valve for charging the high-pressure cylinder, multiple in-line, high-pressure connections for burst testing, high-pressure gage and pressure release connections and ring-type packing on low-pressure piston. Gages indicate pressures directly off the pump and intensifier. The dimensions of the fabricated steel test bench are: width, 37 in.; height, 41½ in.; length, 96 in. The over-all dimensions of the intensifier are 30 × 9 inches.

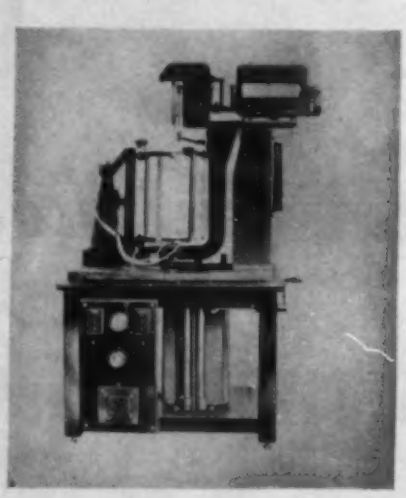
★ BASED ON THE FUNDAMENTAL principle that free water, which condenses as compressed air is cooled, will be precipitated if the air is suddenly expanded, the Stuard automatic separator, manufactured by Railway and Industrial Engineering Co., Greensburg, Pa., is provided with an automatic vent to the atmosphere. This vent is said to eliminate the precipitated moisture and foreign matter collected by the separator, thus allowing the air no opportunity of reabsorbing it. Other features of this separator are that 1) it is combined with the eliminator in one casting, 2) it is entirely automatic, and 3) it is provided with a specially packed chamber designed to eliminate any suspended particles of foreign matter not easily removed in the expansion chamber.

★ THE TAYLOR PROCESS TIMING mechanism for fulscope temperature or pressure controllers, produced by the Taylor Instrument Companies, Rochester, N. Y., and of use to batch process industries, is again on the market. The instrument is designed to be adjusted manually for the desired time period. Timing begins when the apparatus reaches the control point desired, and the process is automatically ended at the end of the time period. This mechanism may be used for 5 interchangeable forms of control: fixed high sensitivity, adjustable sensitivity, adjustable sensitivity with automatic reset, adjustable sensitivity with pre-act and adjustable sensitivity with pre-act and automatic reset.

★ A DETACHABLE-TYPE FITTING for flexible metal hose, with an inside diameter of ¾ in. has been announced by the Seamlex Co., Inc., Long Island City. The unusual simplicity of the Seamlex D. T. which has only three parts, is the key to its reliability. Because of its metal-to-metal seat, concentric guide and automatic stop, the fitting provides triple safety against leakage. It is especially recommended for all-around efficiency and economy at elevated temperatures.

★ FAST - ACTING SYNKRETE, A colorless liquid easy to apply with mop or brush to any clean cement floor, has been developed by Synthex Products Co., New York, N. Y., to overcome the menace of cement dust. A single coat of Synkrete is said to be sufficient to allay dust, and 2 or 3 applications enough to assure permanent control. On particularly bad floors added treatment is recommended.

★ A DIRECT-READING DILATOmeter, Model A-134, which is said to record temperature-dilation changes and



temperature-time changes simultaneously during heating and cooling cycles of ferrous and non-ferrous metals, ceramics and many other materials in solid form, has recently been put on the market by The Bristol Co., Waterbury, Conn. The furnace, designed for temperatures to 2500° F., can be pulled away from the sample for quenching or cooling without disturbing the record. Inside dimensions allow the use of any size or shape of sample up to 1⅝ in. in diameter and 5 in. in length.

★ A COMPACT, PORTABLE TOOL which can be used as either an etcher or demagnetizer, has been developed by Ideal Commutator Dresser Co., Sycamore, Ill. In order to etch, small tools and parts need simply be placed on the work-plate and a switch turned to the proper heat. Fourteen heats are provided which give a wide range for marking all iron, steel and their alloys. To demagnetize, the switch is turned to either No. 1 or 2 position. Thereafter the procedure is the same as in the case of an ordinary demagnetizer.

The company has also announced a small but powerful marking tool which will cut a mark permanently in any kind of material. Used like a pencil, it can be operated from any electrical outlet. The complete marker, 6⅝ in. long, weighs only 19 ounces and is entirely self-contained. A hardened steel point is furnished for ordinary usage. For marking extra hard materials up to 60 Rockwell, scale C, a special diamond point is provided.

★ THE BELLOWS CO., AKRON, Ohio, is manufacturing an electrically controlled air power feed which is said to make possible automatic precision tapping on almost any type of drill press. Speed of feed and retraction are understood to be variable to any degree and are controlled independently. The feed, which may be set for multicycle operation, is slowed at the break through, thus reducing tip burning and drill breakage. Precise depth control allows drilling or tapping blind holes to close tolerances.

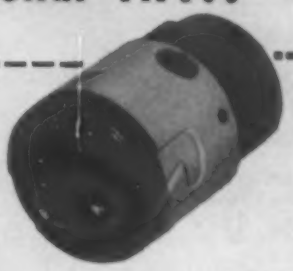
★ FOR STEAM PRESSURES UP TO 150 lb., the Johnson Corp., Three Rivers, Mich., manufactures an "Instant" steam water heater. In this heater a small copper pipe is centered in a large copper pipe, forming a steam chamber between the outer wall of the small pipe and the inner wall of the surrounding pipe. Water entering the inner tube encounters a spiral baffle, which produces turbulence and increases the length of time the water is in contact with the heated pipe wall. When the water enters the second passage it encounters another spiral baffle which again multiplies the length of travel of the water and the velocity along the surface of the steam chamber. The heater can be used as a pre-heater or after heater for feed water. It is also said to be suitable for heating oils and other liquids.

★ WABASH APPLIANCE CORP., Brooklyn, N. Y., announces a new 375-watt reflector type infrared heat lamp, designed to produce higher drying temperatures than are possible with available 250 watt sizes. The Birdseye RE-40 reflector type infrared heat lamp now can be obtained in 125, 250 and 375 watt sizes for flexible temperature control. Standard features of the lamp are a heat-proof Superlok base, a more efficient and durable ceramic heat reflector disc, an "M-filament" and a built-in reflector.

Eleventh in Aico's plastic application series.

Plastics Insure Cord Connector a Perfect Collar Fit...

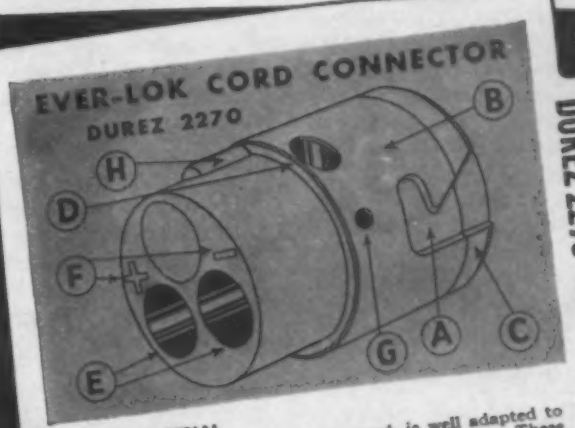
Aico
PRECISION MOLDED FOR ACCURACY



The metal collar on this *plastic* Ever-Lok extension cord connector is molded-in, insuring strength and a perfect fit for dependable service in industrial power systems.

Proper design, correct choice of material and ***precision molding*** are the factors on which that perfect fit depends.

Manufacturers supplying all branches of industry turn to Aico—and Aico's 29 years of molding experience—for the solutions to plastic problems which assure economical production and reliable functional performance.



DUREZ 2270 EVER-LOK CORD CONNECTOR

MOLDING MATERIAL

Durez 2270, a phenolic base compound, is well adapted to molding parts with connected or large metal inserts. These molded-in inserts undergo a certain amount of expansion in the molding process and contraction upon cooling. One of the distinctive properties of Durez 2270 is its ability to absorb this expansion and contraction, caused by temperature changes, without cracking.

MOLD DESIGN

The groove (A) in collar (B) is extended into the plastic body (C) to form a funnel shaped groove for locking and balanced support of the plug. Holes (D) for assembling interior connections are molded at right angles to holes (E). Slight indentations are molded to mark positive and negative terminals (F). White paint can be applied easily to these molded indentations, the surplus wiped off quickly, leaving clean, sharp marks to identify terminals. Holes (G) are placed for screws which hold the connector in its shell. Rib (H) holds the connector in correct position in the shell.

MOLDING METHOD

The cord connector is molded by the transfer method to insure accurate placement of the large insert (B). This method permits speedier molding of intricate shapes in which commercial tolerances in the direction of molding are not allowed.

Write Aico for copies of the complete plastic applications series to date — Nos. 1 to 11.

AICO

Aico PRECISION MOLDING
29th Year

AMERICAN INSULATOR CORPORATION, New Freedom, Pa.

Sales Offices: BOSTON · BRIDGEPORT · BUFFALO · CHATTANOOGA
CLEVELAND · DETROIT · NEW YORK · PHILADELPHIA

BOOKS AND BOOKLETS

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent post-paid at the publishers' advertised prices.

Handbook on Designing for Quantity Production

Edited by Herbert Chase

McGraw-Hill Book Co., Inc., New York, 1944

Price $5.00 **517 pages**

This book is divided into parts, the first a symposium of design, and the second a comparative discussion of Part I. Part I includes chapters on design hints for castings (die and sand), screw-machine products, stampings, forgings, hot and cold headed parts and plastic moldings, each written by a specialist in his field.

In Part II, Mr. Chase takes examples of different types of design and compares them with respect to quantity, quality and cost. Photographs, diagrams and tabular matter supplement the text.

Although certain sections of the symposium, especially the chapter on plastic moldings, could be brought more abreast of the times, the general outline and plan of the book is excellent.

F. B. S.

A Laboratory Manual of Plastics and Synthetic Resins

by G. F. D'Alelio

John Wiley and Sons, Inc., 1943 New York,

Price $2.00 **134 pages**

This manual was prepared in response to numerous requests from college and university staffs for sources of information which might be used as part of a laboratory course in plastics. It is not a book of instructions on manufacturing procedures but rather a set of experiments designed to demonstrate certain chemical principles. Primarily it is aimed for college students who have had organic chemistry. Almost all the well-known resins and plastics which can be prepared readily, even in a small laboratory, have been included. The manual is divided into an experimental section containing 88 experiments, a section on test-methods and a list of industrial sources of supplies suitable for use in the outlined experiments.

★ A COMPILATION OF THE ADvantages of nitrocellulose has been made by Hercules Powder Co., Inc., Wilmington, Del., in a new 4-page pamphlet. The characteristics, technical data and uses of this plastic material are listed in convenient chart form for easy reference.

★ NORELCO SEARCHRAY 150, RECently announced by North American Philips Co., Inc., New York City, is a complete, self-contained industrial X-ray unit which provides a quick, accurate means for non-destructive examination of specimens for internal flaws, cracks or foreign matter. A new 4-page illustrated folder describes the operation of the unit and lists its advantages and applications. Photographs illustrate its use in X-ray examination of aluminum, steel, copper, hard rubber parts, plastics and other materials.

★ "HOW TO MEASURE IN MICRO Inches" is a 20-page booklet which Continental Machines, Inc., Minneapolis, Minn., has compiled for both the novice and the expert. Dealing with the fundamentals of precision measurements and their applications to daily production control, this brochure should be of value to inspectors, machinists and plant engineers. Photographs, charts and drawings illustrate the instruments, and show the relationship of various dimensions as they are affected by the temperature of materials being measured. In a second leaflet by the same company—called "Jewels of the Industry"—instructive slides on the care and use of their precision instruments are illustrated and an invitation is extended for their presentation before any interested group.

★ PHOTOSWITCH DENSITOMETER Series D90—the recently introduced photoelectric control for measuring the optical density of liquids, gases, films, filters, plastics and similar transparent materials is described in a new 4-page bulletin released by Photoswitch, Inc., Cambridge, Mass. Two beams of light from a single source are alternately impressed upon the phototube at a high rate of speed. The material to be measured is placed in one of these beams so that the phototube alternately looks, first at the light source directly and then through the intervening material. The ratio of the 2 sets of impulses thus generated represents the light transmission of the material. This system was developed for the control of industrial processes and to maintain uniform density of materials in quantity production.

★ THROUGH THE USE OF MANY schematic photodiagrams, the new Leeds and Northrup catalog on Type P combustion control endeavors to show the effects of this system on the efficient operation of an industrial power plant. The booklet which is published by Leeds & Northrup Co., Philadelphia, Pa., features the regulation of fuel-feed and draft by simple electrical balance, and the push-button regulation of any of the various drive units. It also explains how the whole unit can be serviced without interruption of operation.

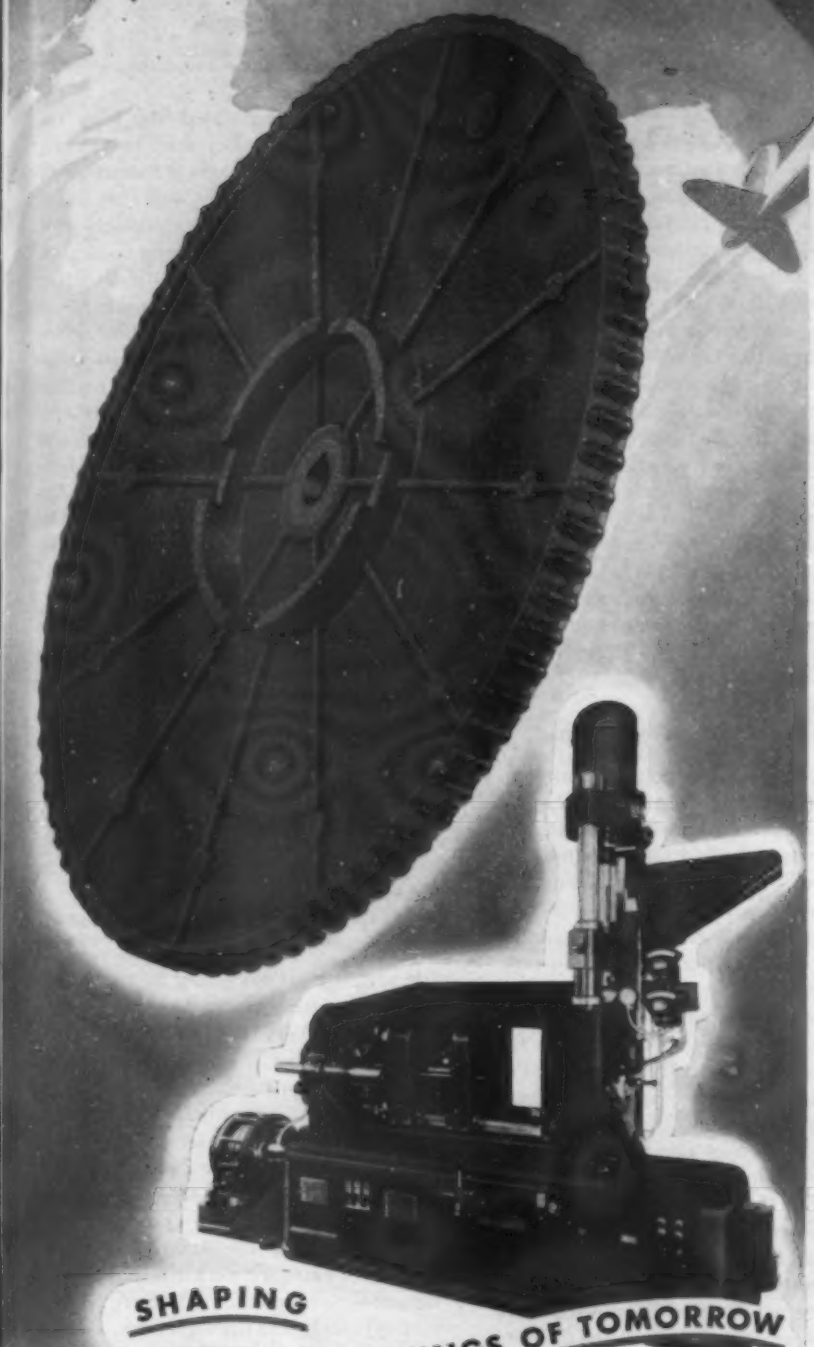
★ STYLE "S" SURE-GRIP MASTER collets and pads are discussed in a pamphlet recently issued by Hardinge Brothers, Inc., Elmira, N. Y. The solid performance achieved through the use of these collets is attributed to the fact that the head angle of the master collet and the gripping surfaces of the pads are the same as solid collets. There are no holes in the head angle nor tapped hobs in the pads. In addition, an independent lock anchors each pad section in place.

★ A NEW CATALOG, "EXTRUDED Plastic Tubing," issued by Irvington Varnish & Insulator Co., Irvington, N. J., describes such company products as Irv-O-Lite types XTE-30 and XTE-130, Iviflex extruded tubing, Transflex transparent plastic tubing, Hyflex plastic tubing and Irvington plastic marker insulators. Product sheets describing the characteristics and application of these items supplement the text.

★ "TOOLITE—A THERMOSETTING Phenolic Plastic for Casting Tools, Dies and Fixtures," is the name of a 4-page folder describing a new material manufactured by Adhere, Inc., Los Angeles, Cal. High-impact strength, greater uniformity and more durability are features claimed for this new ready-compounded plastic. In this folder a table lists the physical properties and characteristics of Toolite III; procedures of "Toolite" are explained; and the simple steps in producing tools, dies and fixtures with the material are clearly illustrated.

★ FOUR 8-PAGE PAMPHLETS DEscribing the Alemite lubrometer centralized lubrication system, progressive lubricating system, dual progressive system and dual manifold system of lubrication have just been released by Alemite Div., Stewart-Warner Corp., Chicago, Ill. The machines employed in the operation of each system are pictured and discussed in detail, and installation and operational instructions are given.

When a B-17 Starts Skyward . . .



As America's mighty bombers rise slowly, *surely* into the sky on their missions of destruction, every part of their elevating mechanisms must function perfectly, without possibility of failure.

Typical of precision parts in the B-17's flying gear is this elevator tab control wheel, cast on the 12-ounce Lester by the Plastic Tool and Die Corp. of Los Angeles. Made of Tenite II in H2 flow, it combines light weight with structural strength; note thin-walled, ribbed main section and metal insert at hub. It is 10 inches in diameter, weighs 10 ounces, and is molded on a 45-second cycle.

This is not an easy casting to make. To quote the manufacturer: "The area is large and it requires considerable pressure, such as is generated by the Lester, in order to fill the extreme edges; including the serrations."

Do you have full information on the various models of the Lester line? If not, write today!

FREE DATA

You can now inject *all* plastic materials, thermoplastic and thermosetting, on one machine. Write for full information.

These are LESTER *Exclusives!*

1. **VERTICAL HEATING CYLINDER** *with hollow injection plunger delivers more material at higher pressure per energy input.*
2. **EXTRA INTERCHANGEABLE HEATING CYLINDERS** *greatly expand operating range.*
3. **POSITIVE DIE LOCKING** *virtually eliminates flash.*
4. **CENTRAL DIE ADJUSTMENT** *assures constant and absolute parallelism of die plates under all conditions.*
5. **MASSIVE "CHROME-MOLY" STEEL BEAM FRAME** *give 3 to 5 times strength and rigidity afforded by conventional bar construction.*
6. **COMPLETE SIZE RANGE**—*4, 6, 8, 12, 16 and 22-ounce models.*

SHAPING THE THINGS OF TOMORROW

LESTER

NEW YORK CITY • DETROIT • [illegible]
LOS ANGELES • CHICAGO • CINCINNATI
SAN FRANCISCO
[illegible]
DOWDING & DOIG, LTD., LONDON, ENGLAND • SCOTT & HOUGHTON PTY. LTD., SYDNEY, AUSTRALIA & WELLINGTON, N.Z.

INJECTION MOLDING MACHINES

National Distributors: **LESTER-PHOENIX, INC.** 2711 CHURCH AVENUE CLEVELAND • OHIO

WASHINGTON ROUND-UP

R. L. VAN BOSKIRK, Washington Editor

Decorative laminate

There are many indications to support a belief that some of the restrictions on decorative laminate may soon be lifted. Two of the most obvious reasons are: 1) armament demands show signs of lessening and 2) materials are in better supply. But this good news should be taken cautiously. Limitations will be lifted slowly and carefully because: 1) there is not enough material to permit wide open distribution for any and all uses of decorative laminate, and 2) there are neither enough facilities nor sufficient manpower to meet the potential demand and at the same time keep war production at satisfactory levels.

The machinery for permitting this gradual rebirth of decorative laminate is already in existence. Since M-246 (phenolics) and M-331 (urea and melamine) allocate resins against a description of end use, it only remains for the laminator and his customers to describe accurately and carefully the decorative use in question.

Policing of this and similar situations in the future can best be done by the industry itself. WPB will take a reasonable and fair attitude as long as this is done. On the other hand, WPB will take proper steps to eliminate abuses if it is found that wholesale "chiseling" crops out through lack of self-policing, accuracy and honesty of end use description.

Up to now the term "decorative laminate" has been used to describe almost any laminated surfacing material. There is a wide range of essentiality which extends, for example, all the way from an X-ray table top (for which no other material is technically satisfactory) on down to a dinette set for war housing. In between there are such things as table tops for radio operators in airplanes, mess tables on shipboard, industrial cafeteria table tops and civilian restaurant tables.

It must be remembered that the decorative laminate is not a war baby. Long before Pearl Harbor it had received wide acceptance as a superior material for such things as bar paneling, public building and movie theatre wall finishing, and many other purposes aside from the well-known table top uses. Laminated kick plates and push plates on store doors were well on the way to becoming standard applications before Pearl Harbor and the material has been listed in builders' catalogs for many years. Its characteristic durability and permanently fine appearance have made this material extremely popular in applications where abuse was the rule rather than the exception.

Therefore, if restrictive bars were suddenly loosened, the pent-up demand could swamp the industry and raw materials suppliers. However, by gradually permitting certain types of end uses not now allowed, WPB officials believe it may be possible to sponsor a gradual return to the manufacture of increasing quantities of out-and-out civilian products. They will keep a close watch on each end use, and will have to determine the relative essentiality of such things as paneling, restaurant tables, and like items.

So far there has been little or no complaint about those men in WPB who have handled the various branches of the plastics industry and its sources of supply. However, the exodus from the Army or defense industries back to private industry is well under way. It would be wise on the part of the industry to keep an eye on the replacements. At least a portion of the newcomers should be from the plastics industry so that their counsel and advice may be at hand during this extremely critical transition period.

Quarterly allocations for laminates

The quarterly allocations for laminating and specialty resins permitted by the May 9th amendment to M-246 (phenolic resins) has not worked out as happily as anticipated. Both industry men and WPB were in favor of giving it a trial since there seemed to be the possibility of a reduction in paperwork and red tape. WPB officers are frank to admit that it hasn't worked out that way—the result has been even more paperwork. The laminating industry has always worked on a month-to-month basis, and the attempt to convert it to a quarterly basis has convinced nearly every one that there were natural, economic reasons which more or less dictated the month-to-month system.

Laminators and users of specialty resins should note that the order providing quarterly allocation is optional, not mandatory as many seemed to believe. If operations on a quarterly basis cause trouble, WPB will have no objection to a change back to the monthly basis.

Soldiers over 30 may be returned to industry

A procedure whereby certain soldiers could be released on a furlough basis for availability in industry was established many months ago. It may be wise for employers to review that possibility. It should be obvious that the best chances for obtaining releases of men now in the Army apply to men over 30 who have not attained key positions in their particular military unit. It is not likely that the Army will release younger men or those who have become most important cogs in the Army machine.

It must be proved that the man requested had been a key man in his private occupation, that there is a shortage of technicians in his category, and that it has been impossible to secure a replacement. Each request must contain the requested man's full name, age and date of birth; home address; number and address of his Selective Service Board; date of induction or enlistment; Army serial number; description of job in detail; previous work experience; length of time with employer; salary at time of induction; and a statement in justification of classification of soldier as a key employee. Appeals should be made only in case of dire necessity and addressed to Office of the Adjutant General of the U. S. Army, Washington, D. C.

If the present location of the soldier can be given it will materially shorten the time required to locate him. Further details for procedure may be obtained by writing to the Chemicals Bureau, Temporary Building S, Washington, D. C.

This process may be of especial value to the chemicals industry because it employed numerous expert technicians under 40 when the draft was initiated, and a fair number might now be released.

Notes on manpower

Practically all physically fit men under 26 are now either in the Armed Forces or soon will be. Very few were deferred in the plastics industry. Some remain in the related chemicals industry because the last 10 years' expansion has been so great that thousands of young chemists just out of college were hired. Many of these had become invaluable research and technical men on new products now sorely needed by the Armed Forces. A few in this category were deferred because their loss to industry would have been an even greater loss to the war effort.

For men 26 through 29 the situation is not yet clear. Some districts claim they are already being processed but no date for induction has been set. There is good reason to believe that men over 26 who have been deferred once on occupational grounds may continue to be deferred in the future. It may be wise for proprietors to review the present status of their men in the 26 to 29 group and make sure that local boards have up-to-date information. Every six months of service adds to their experience and responsibilities.

For those over 30, the only qualification for deferment seems to be that they are working in an essential industry.

BAKER PLASTICIZERS

for:

I. Low Temperature Flexibility

II. Retained Flexibility

Baker Plasticizers Contain No Phthalate

THE

BAKER CASTOR OIL COMPANY

Established 1857

120 Broadway, New York 5, New York

Jersey City, New Jersey Los Angeles, California Bayonne, New Jersey

NEWS OF THE INDUSTRY

LOUIS MANSFIELD ROSSI

★ LOUIS MANSFIELD ROSSI, VICE-president of Bakelite Corp., died on May 25, following a sudden illness.

★ E. I. DU PONT DE NEMOURS & Co., Inc., has announced a price reduction of 50¢ per pound for nylon molding powder. When the material was first placed on sale in June 1942, the price was $2.10 per pound. The price of "Lucite" methyl methacrylate resin in clear transparent sheets has also been lowered. The reductions range from 4.5 percent for the thinnest type of sheeting to 10.8 percent for thicker sheets. A substantial lowering of all prices for formaldehyde in bulk and package quantities has become effective in the Electrochemicals Dept. of the company. On tank car lots, the reduction amounts to 10 percent or 40 cents per 100 pounds. On packaged formaldehyde the change amounts to 25 cents per 100 pounds.

★ DR. JOSEPH G. DAVIDSON WAS recently elected president of Carbide and Carbon Chemicals Corp. and of Carbide and Carbon Chemicals Ltd., and the following men have been chosen as vice-presidents: L. J. Bowditch, W. S. Brackett, H. S. Bunn, G. T. Felbeck, R. N. Graham, G. B. Landes, H. B. McClure and W. F. Reich, Jr.

Dr. George O. Curme, vice-president and director of research of the corporation was presented with the 1944 Willard Gibbs Medal by the Chicago section of the American Chemical Society, for his accomplishments in pure and applied chemistry.

★ THE TRADE NAME "ALLYMER" has been selected by Pittsburgh Plate Glass Co., Columbia Chemical Div., Barberton, Ohio, for the complete line of allyl resin monomers formerly known as Columbia Resins, C. R. 39, etc. Identifying numbers such as 39 and 149 will be retained to designate types.

★ WITH THE ACQUISITION OF the Reynolds Molded Plastics Div. of Reynolds Spring Co., Continental Can Co., Inc., New York City has formed a plastics division under the management of O. G. Jakob. Headquarters will be located in New York City. It will comprise a Laminated Plastics Dept. handling Marco-Board and a Reynolds Molded Plastics Dept. handling the various products of the new factory.

★ THE LARGE CHEMICAL PLANT of Catalin Corp. at Matawan, N. J., has been purchased by Orbis Products Co., New York City, to provide for its expanding business.

★ A GENERAL REDUCTION OF 10 percent in the price of Plexiglas has been made by Rohm & Haas Co. The new schedule shows representative prices of 75¢ per sq. ft. for $^1/_{16}$ in. material and 97¢ for $^1/_8$ in. material.

★ HARVEY G. GREER HAS BEEN appointed to the technical-service staff of Witco Chemical Co., Akron, Ohio, to handle a growing line of products for the rubber and synthetic rubber industries. Mr. Greer was formerly with the Rubber Reserve Corp.

★ THE PRICE OF GEON POLY-vinyl resins, manufactured by B. F. Goodrich Co., Akron, Ohio, has been reduced from 4 to 5 percent on carload lots of 30,000 lb. or more. Geon 101 and 102, previously sold at 42 cents per lb., has dropped to 40 cents, and Geon 202 and 203, sold in lots of 30,000 lb. or more has also been reduced 2 cents per pound.

★ ACCORDING TO A RECENT announcement, James Anderson will be in charge of the Plastics Engineering Div., Dow Chemical Co., Midland, Mich. Mr. Anderson will have authority over all advertising, publicity and other plastics promotion activities.

★ JAMES W. McLAUGHLIN, PRESIdent, Bakelite Corp., has announced the election of the following vice-presidents at a recent meeting of the Board of Directors: C. W. Blount, Gordon Brown, H. S. Bunn and R. B. Lowe.

★ SAM KLEIN HAS BEEN NAMED Western sales manager of Calco Chemical Div., American Cyanamid Co., Bound Brook, N. J. Mr. Klein's office is located in Chicago.

★ A NEW YORK OFFICE HAS BEEN opened by the Thermex Div., Girdler Corp., of Louisville, Ky., at 150 Broadway. The office will be under the direction of Hugh Cameron.

★ LEE T. BORDNER, FORMER sales manager of Eclipse Moulded Products Co. has resigned to accept a position as executive vice-president of Electroforming Co., Hartland, Wis.

★ FRED H. HAGGERSON HAS BEEN elected president of Union Carbide and Carbon Corp. He succeeds Benjamin O'Shea, who has held the post of president since 1941 and now becomes chairman of the Board.

★ CHARLES F. McKENNA, JR., will succeed Roger Coleman as manager of the Special Products Sales Div., General Aniline & Film Corp., New York City. Mr. McKenna will handle the carbonyl iron powders, and "Polectron" products.

★ EDWARD ROSE, FORMERLY OF Plastic Engineering Co., is now associated with Wright Plastics, Inc., Bronx, N. Y.

★ THE PLANT AND OFFICES OF Penn-Plastics Corp. have been moved to 924 Cherry St., Philadelphia, Pa.

★ ARTHUR J. MILLER HAS BEEN elected president of Chicago Wheel & Manufacturing Co., Chicago, Ill., producers of mounted wheels, grinding wheels and allied abrasive products, replacing his father, the late Henry E. Miller, founder of the company.

★ HAROLD BRAYMAN HAS BEEN appointed director of Public Relations Dept., E. I. du Pont de Nemours and Co., Inc., to succeed Theodore G. Joslin, who died on April 12.

★ IN ANNOUNCING THE FORMAtion of Resin Industries, Santa Barbara, Cal., Grant C. Ehrlich, president, stated that the new company was designed to serve the West Coast in the production of synthetic elastomers, including vinyl resin, ethyl cellulose and similar compounds.

★ THE OFFICES AND PLANT OF Whiteford Plastics Co., Inc., has been moved from 439 Lafayette St. to 311 West 66th St., New York 235, N. Y.

★ GEORGE K. SCRIBNER, PRESIdent of the Society of the Plastics Industry, has announced the organization's plans for an industry-supported national plastics exhibit after the war. The project is a recommendation of the Society's Postwar Planning Committee and will include a complete display of the new materials which have been developed during the war and many plastics applications which are products of the war effort. Machinery manufacturers will demonstrate new equipment which will include many innovations. (*Please turn to page 158*)

AFTER MARS...A RENDEZVOUS WITH VENUS
When Columbia turns from war . . . to peace . . . its creative skill and versatile craftsmanship will play no small part in bringing new glamour and ingenuity to molded plastics of tomorrow. For Columbia Plastics combine unexcelled engineering ability, design sense, scientific research, production technique . . . all made possible by a pioneering organization of vision and unrivalled facilities. In post war days, Columbia will continue to pioneer the road to new perfection in products of molded plastics.
COLUMBIA Plastics
COLUMBIA PROTEKTOSITE CO., INC. CARLSTADT, N.J.

★ BARNES & REINECKE, INDUSTRIAL designers and engineers, Chicago, Ill., announce the appointment of Earl L. Hadley as general manager. Mr. Hadley was formerly with Associated Engineers, Inc.

★ HERMAN R. THIES WILL HEAD the newly created Plastics and Chemical Sales Div. of Goodyear Tire and Rubber Co., Akron, Ohio. Robert D. Vickers will be assistant manager of the department.

The company has also established a new Synthetic Sales Division under the leadership of C. P. Joslyn. Aiding him in planning for the postwar sales of synthetic rubber products are H. R. Thies, A. F. Landefeld, O. C. Pahline, H. D. Herbert.

R. D. Vickers has been appointed head of plastics and chemicals sales for the company in the eastern region of the United States. His headquarters will be in New York.

★ THE PLANT OF TECKNA PLASTICS Co. has been moved from 788 Union St., Brooklyn, N. Y., to Northern Blvd. & 223rd St., Bayside, N. Y.

★ WITH THE FORMATION OF A Plastics Division known as Wayne Plastic Products, the Wayne Oil Burner Co., Fort Wayne, Ind., has expanded its activities into a new field. New 100-ton compression equipment has been installed in the plant which has all the facilities needed for designing, mold making, chrome plating and molding located under one roof. At present, Wayne Plastic Products is doing only custom molding for manufacturers using plastic parts in war equipment, but postwar plans include production of many standard domestic and industrial items.

★ THIS PLASTICS AGE EXHIBIT, arranged by MODERN PLASTICS magazine, has completed a 20-day showing at the Oklahoma City Chamber of Commerce. The exhibit formed part of the Farm Chemurgic Clinic held in Oklahoma City, Okla., on May 18, 19 and 20, for the purpose of developing practical postwar plans for the improvement of the midwest area, increasing industrial utilization of the application of chemistry to agriculture and minerals, and distributing information about new processes, methods and new products.

Sorry!

★ DUE TO A TYPOGRAPHICAL ERror, the wall section of the kick-out panel, described on page 123 of the May issue, was stated to be $^1/_{32}$ in. instead of $^5/_{32}$ inch.

★ IN THE ARTICLE, "EFFECT OF Environmental Conditions on Mechanical Properties of Organic Plastics—Part I," which appeared in the June issue, the formula for modulus of elasticity that appeared in Fig. 1, page 121, was inverted. It should have read:

$A\sigma/A\epsilon$ E (Modulus of Elasticity)

SPEECHES OF THE MONTH

★ UNDER THE JOINT AUSPICES OF The Canadian Section, Society of the Plastics Industry, and the Toronto Paint and Varnish Production Club, a complete technical session of the Canadian Chemical Conference was given over to plastics on June 6, 1944. A. E. Byrne, Canadian General Electric Co., Ltd., acted as chairman. Brief digests of some of the speeches presented at this session appear in the following paragraphs.

Under the title "A Parable in Plastics," Willard H. Dow, president of Dow Chemical Co., considered problems involved in the future development of polymer thermoplastics. The speaker emphasized the importance of maintaining monomer purity and the necessity for obtaining a polymer of uniform and controllable molecular weight distribution if manufacturers are to achieve increased production and lowered costs. He also pointed out that if postwar markets are to be extended, polymer manufacturers must seek means of reducing fabrication costs. In considering future developments in fabrication, Dr. Dow suggested the possibility of adapting some phases of thermoplastic blowing technique to injection molding.

In a talk on "New Materials for Tomorrow's World," L. F. Livingston, manager of the Extension Div. of E. I. du Pont de Nemours and Co., Inc., highlighted plastics contributions to the Allied front and foreshadowed some of their peacetime applications. Particular attention was given to Polythene, adaptable for items ranging from collapsible tube containers to cable and wire insulation, adhesives and waterproof coatings; nylon molding powder, used for switchette housings and spools for winding the wire coils activating aircraft instruments; and the rayon tow now replacing long-line flax in war equipment. Other chemical developments include special military paints, fine-grain industrial X-ray film, and saboteur-proof "acoustic fence" for warplant protection. A technique for electrolytic tinning which uses less power and tin and is twice as fast as many older methods was also discussed.

A comprehensive treatment of the historical background, chemical structure, properties and uses of "Acrylic Resins for Plastics and Coatings" was offered by D. A. Rothrock of the Plastics Div., Rohm and Haas Co. Data were presented on the physical properties of typical acrylic monomers, and it was pointed out that a promising use of the acrylic resins is linked with the solubility of the higher members of the series in petroleum oils. Acrylonitrile offers many possibilities as an intermediate in synthetics. Wartime uses are yielding data on the properties of acrylics under varying conditions which will aid in selecting the postwar fields they may serve to best advantage.

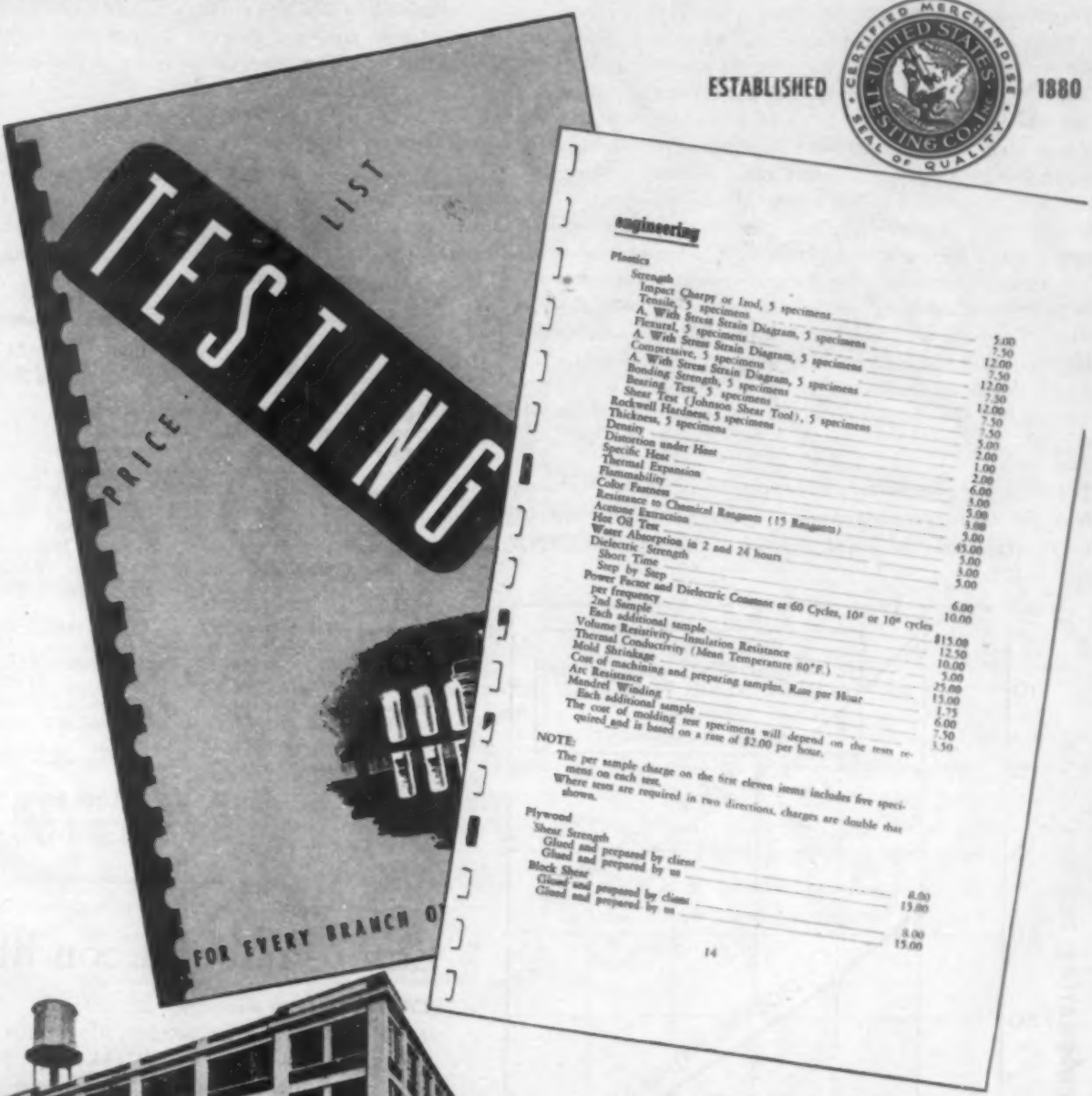
Speaking on "The Behavior of Polymers and Copolymers," R. F. Boyer, Plastics Development Div., Dow Chemical Co., reviewed the effects of molecular weight, chemical composition and temperature on such properties as softening point, impact strength and cold flow. After stressing the general convenience of thermal expansion measurements for characterizing the temperature behavior of thermoplastics, he applied these ideas to the styrene-butadiene and vinylidene-chloride-vinyl chloride systems. Data were presented to show how the softening point, tensile strength, solubility and electrical properties will vary with the proportion of each ingredient in the copolymer.

"Polythene" was the subject of a talk by Frank C. Rice of the Plastics Div., Canadian Industries Ltd. Although, as the speaker stated, much of his information is now available in published form, several worthwhile points were brought out with regard to the fabrication of the material and its possible uses. Among future applications Mr. Rice listed the development of a collapsible tube, heavy-walled containers for the transportation of corrosive liquids and solvent solutions or aqueous emulsions for use in the paper and fabric coating fields. It was predicted that Polythene tubing should have particular value where low temperatures preclude use of other types, as in airplane fuel lines.

E. F. Fiedler, of the Plastics Divisions of the General Electric Co., spoke on "Liquid Phenolic Resins and their Applications." After describing the development and composition of these resins, he enumerated the principal fields in which they are finding application: as glues for plywood, particularly in aircraft construction; in the production of impreg and compreg; as insulators for transformers and armatures; as protective coatings for chemical equipment. A special type of cast resin is used to form vessels, pipes, condensers, etc., for chemical processing of highly corrosive materials. An expanding application for cast phenolic resins is their adaptation for tooling dies. Here the most serious difficulty is the slight change in dimensions on aging, but Mr. Fiedler prophesied that work now in progress with asbestos fillers would probably correct this disadvantage. He stressed the point that phenolics still remain the work horses of the plastics industry and will continue to find new, large-volumes uses because of their fine properties and low cost.

OUR NEW PRICE LIST COVERING ALL OF OUR SCIENTIFIC TESTS, INCLUDING THOSE ON PLASTICS, IS AVAILABLE TO EXECUTIVES ON REQUEST.

ESTABLISHED 1880


TESTING
PRICE LIST
FOR EVERY BRANCH OF
engineering
Plastics
Strength
Impact Charpy or Izod, 5 specimens 5.00
Tensile, 5 specimens 7.50
A. With Stress Strain Diagram, 5 specimens 12.00
Flexural, 5 specimens 7.50
A. With Stress Strain Diagram, 5 specimens 12.00
Compressive, 5 specimens 7.50
A. With Stress Strain Diagram, 5 specimens 12.00
Bonding Strength, 5 specimens 7.50
Bearing Test, 5 specimens 12.00
Shear Test (Johnson Shear Tool), 5 specimens 7.50
Rockwell Hardness, 5 specimens 7.50
Thickness, 5 specimens 5.00
Density 2.00
Distortion under Heat 1.00
Specific Heat 2.00
Thermal Expansion 6.00
Flammability 5.00
Color Fastness 5.00
Resistance to Chemical Reagents (15 Reagents) 9.00
Acetone Extraction 5.00
Hot Oil Test 45.00
Water Absorption in 2 and 24 hours 5.00
Dielectric Strength 5.00
Short Time 5.00
Step by Step 6.00
Power Factor and Dielectric Constant at 60 Cycles, 10³ or 10⁶ cycles per frequency 10.00
2nd Sample $15.00
Each additional sample 12.50
Volume Resistivity—Insulation Resistance 10.00
Thermal Conductivity (Mean Temperature 60°F.) 5.00
Mold Shrinkage 25.00
Cost of machining and preparing samples, Rate per Hour 15.00
Arc Resistance 1.75
Mandrel Winding 6.00
Each additional sample 7.50
The cost of molding test specimens will depend on the tests required and is based on a rate of $2.00 per hour. 3.50
NOTE:
The per sample charge on the first eleven items includes five specimens on each test.
Where tests are required in two directions, charges are double that shown.
Plywood
Shear Strength
Glued and prepared by client 8.00
Glued and prepared by us 15.00
Block Shear
Glued and prepared by client 8.00
Glued and prepared by us 15.00
14

Member of American Council of Commercial Laboratories

TESTING

UNITED STATES TESTING COMPANY, INC.
ESTABLISHED 1880
HOBOKEN, NEW JERSEY
PHILADELPHIA, PA WOONSOCKET, R. I. CHICAGO, ILL NEW YORK, N. Y.

Stiffness and brittleness

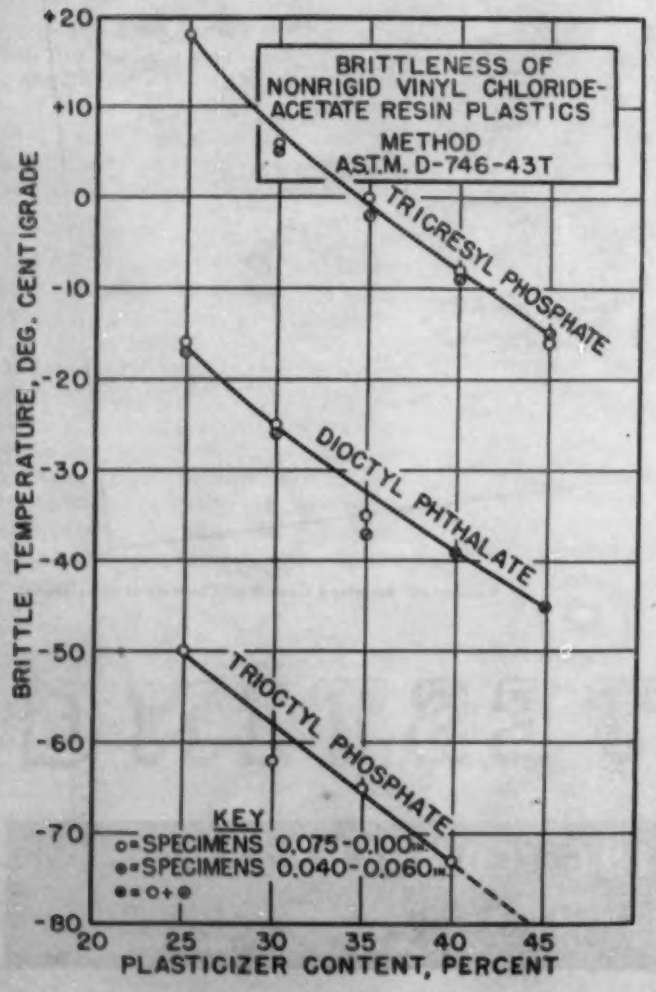
(*Continued from page 124*) addition to resin VYNS has translated the log stiffness-temperature curve approximately −60 degrees C.

Figure 14 shows stiffness at 25° C. as a function of dioctyl phthalate concentration in resin VYNW. It will be noted that this curve also has the characteristic inverted "S" shape. Thus, the stiffness-temperature function for a given plasticizer concentration is similar to the stiffness-plasticizer concentration curve at a given temperature.

Attention is called to the fact that the inverted "S"-shaped stiffness characteristic is similar to the familiar probability integral. This might be taken to mean that the probability function defines the extent to which a new degree of freedom is activated as the temperature is increased throughout the region herein studied. The integrated form up to any temperature thus would define the total activation up to that temperature. According to this picture, this degree of freedom has not been assumed in the rigid form, whereas it has been completely energized in the nonrigid or elastomeric state. An increase in the energy of thermal agitation contributes to a stiffness reduction at any temperature, but at a much lower rate than that obtained over the temperature region in which a new degree of freedom is being activated. Therefore, it appears that the plasticizers of Figs. 9, 10 and 11 have widely different effects on the temperature rate and locale at which this degree of freedom is assumed.

The effect of plasticizer concentration on brittle temperature is summarized in Fig. 15 for tricresyl phosphate, dioctyl phthalate and trioctyl phosphate in vinyl chloride-acetate resin VYNW. This illustrates the marked dependence of this property on both type and amount of plasticizer.

15—*Effect of plasticizer concentration on brittle temperature for tricresyl phosphate, dioctyl phthalate and trioctyl phosphate in vinyl chloride-acetate resin VYNW*



Conclusions

The stiffness and brittleness characteristics of elastomers, obtained by the procedures described herein, are extremely useful in studying the low temperature behavior of these materials. The information is an aid to compound design and evaluation.

Acknowledgment

The authors are indebted to Messrs. I. L. Hopkins and G. G. Winspear, Bell Telephone Laboratories, and to Mr. N. J. Rakas, Chrysler Corp., whose cooperation and low temperature facilities were invaluable in running many of the tests discussed in this paper.

References

[1] Koch, Kautschuk *16*, No. 12, 151 (1940).
[2] Liska, Ind. Eng. Chem. *36*, 40 (1944).
[3] Kish, Rubber Age *53*, 131 (1943).
[4] Garvey, Ind. Eng. Chem. *34*, 1322 (1942).
[5] Green, Chollar and Wilson, Rubber Age *53*, 319 (1943).
[6] Gloor, Modern Plastics *17*, 62 (April 1940).
[7] Oberg, Schwartz and Shinn, Modern Plastics *20*, 87 (April 1943).
[8] Gloor and Gilbert, Ind. Eng. Chem. *33*, 397 (1941).
[9] Reed, Ind. Eng. Chem. *35*, 429 (1943).
[10] Russell, Ind. Eng. Chem. *32*, 509 (1940).
[11] Graves and Davis, India Rubber World *109*, 41 (1943).
[12] Selker, Winspear and Kemp, Ind. Eng. Chem. *34*, 157 (1942).
[13] Kemp, Malm and Winspear, Ind. Eng. Chem. *35*, 488 (1943).
[14] Martin, Rubber Age (N. Y.) *52*, 227 (1942).
[15] Myers, Modern Plastics *20*, 81 (October 1942).
[16] Jones and Snyder, India Rubber World *108*, 137 (1943).
[17] Yerzley and Fraser, Ind. Eng. Chem. *34*, 332 (1942).
[18] Sagajllo, Bobinska, Sagnowski, Rubber Chem. & Tech. *12*, 344 (1939).
[19] McCortney and Hendrick, Ind. Eng. Chem. *33*, 579 (1941).
[20] A.S.T.M. Standards on Plastics. Philadelphia: American Society for Testing Materials (1943).
[21] Olsen Stiffness Tester, Tour-Marshall and Olsen Design, described in U. S. Patent 2,049,235.
[22] Clash and Berg, Ind. Eng. Chem. *34*, 1218 (1942).
[23] Trayer and March, Nat. Advisory Comm. Aeronaut., Dept. 334 (1929).

Environmental conditions

(*Continued from page 130*) 24, 29, 32, 33, 34, 44, 45, 48, 53, 59, 60, 65, 81, 87, 88, 89, 91, 93, 109, 110, 113, 117, 120, 121, 125, 133, 136, 141, 142, 144, 148). Much additional data on long-time properties are expected to be published in the next few years. Figure 40 shows typical creep curves for a fabric-filled phenolic at several stress levels (136). Figure 41 shows the total creep in 1000 hr. at various stress levels for several molded phenolics (136). Figure 42 shows stress-time to rupture data for several plastics (45, 53).

If relatively small loads are alternately applied to a specimen and then removed, and the process is repeated for thousands or even millions of cycles, failure will occur at stresses far below those which are required to produce failure in short-time laboratory tests. Such cyclic "fatigue" tests are especially important for the evaluation of materials which are to be used in the construction of machinery, since cyclic stress conditions are especially prevalent in such apparatus. Materials for use in aircraft, especially, must have good

1 SAVES COST OF METAL DIES

Compound curvatures and fairly sharp bends without any inside radius are produced in PANELYTE #906 parts by inexpensive forming dies of Kirksite, cast phenolic, laminated phenolic or hardwood.

2 SIMPLIFIES AND SPEEDS PROCESSING PANELYTE

#906 can be stamped, bent or drawn in process similar to—but much simpler than metal stamping. No need for hot molds. Material is merely heated to temperatures higher than those used in manufacture, molded, and left for very short period in mold for partial cooling.

3 ELIMINATES NEED FOR HEAVY EQUIPMENT OR HIGH PRESSURES

The fast and economical forming of PANELYTE #906 is accomplished with small air cylinders — and, in some cases, hand presses can be efficiently used.

If you manufacture or use laminated phenolic parts of complex design, Grade 906 PANELYTE may save you time — and money. This fully cured thermo-setting sheet plastic opens entirely new fields in plastic fabrication. Write for Engineering Bulletins on Grade 906 . . . and samples.

PANELYTE — *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS

fatigue strength; vibrations are common in aircraft, and fatigue failures in such structures are apt to prove especially disastrous. Fatigue data on plastic materials are scarce, but very good work is being done in this field and several recent publications contain considerable valuable information (4, 5, 16, 17, 18, 39, 40, 43, 44, 46, 47, 48, 53, 54, 72, 85, 106, 114, 117, 127, 132, 139, 140, 141, 142, 148, 149).

Typical fatigue curves for cyclic bending are shown in Fig. 43 (43, 46, 106, 141). A relation between cyclic bending and repeated impact has been demonstrated (47). War requirements, our tremendous aircraft production program and increasing interest in the use of plastics for functional parts of machinery and equipment, have greatly stimulated interest in fatigue properties, and a great deal of information on the strong plastics will be made available over the next 2 or 3 years.

Comparison with other materials

Organic plastics embrace such a wide variety of chemical and physical structures that generalizations are difficult. In general, however, the mechanical behavior of metals, wood, cellulosic materials, glasses, etc., finds a counterpart in some plastic or another. No organic plastic yet available will withstand as high temperatures as will metals because of chemical decomposition, but the new organic silicon polymers are a step nearer to equality in this respect. As previously discussed, plastics are affected by environmental conditions in ways which resemble, qualitatively, the ways in which other materials are affected although quantitative relations vary greatly and depend upon the nature of both plastic and environment.

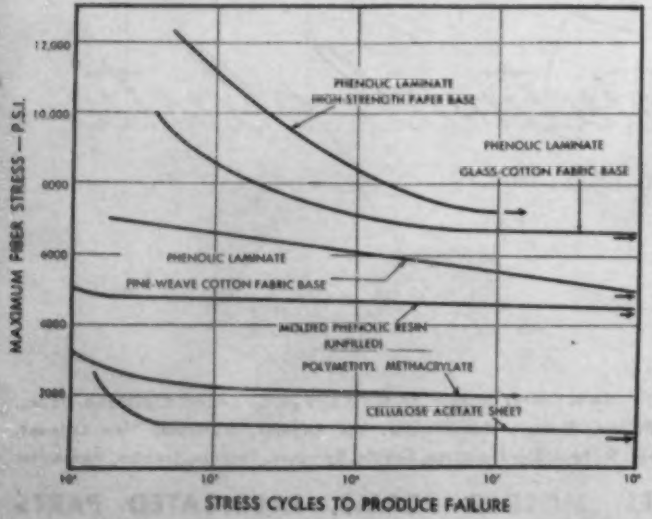
What of the future?

Data on material properties greatly facilitate engineering design, but a successful machine or structure can never be developed by purely mental processes. Actual trial of a full-scale model is the final test of the designer's skill, and it always will be. It is a rare case indeed for such a model to function perfectly the first time; minor design changes are almost always necessary. Good design, however, should prevent complete failure of a part and should minimize the necessity for major alterations.

Good design, from this point of view, will depend upon good information on material properties and upon sound experience in the application of this information. Plastics manufacturers, materials engineers and design engineers are all acutely aware of the need for good data on properties, and a start has been made toward the collection of such information. This work will continue and the next few years will see a tremendous increase in the amount and quality of data available. The range of physical and environmental conditions over which such data are obtained will also be broadened.

Since geometrical factors, methods of fabrication and similar variables greatly influence the behavior of a component, it will not always be possible to translate material properties data into data on the performance of the finished component. Properties data involve standard specimens prepared in a standard way. A finished component involves all of the intangibles contained in the expressions "engineering experience" and "engineering judgment." Accurate properties data will prove useful tools in the hands of the experienced designer but can never be handled mechanically by a robot. Plastics will serve as fundamental engineering materials and in the hands of the skilled engineer will prove increasingly useful in the mechanisms of our progressing technology.

43—*Bending fatigue data for several plastics*



Better brush work

(*Continued from page 85*) is also molded of phenolic rather than made of metal. Hardened ink pigment often cements the ferril to the threading of the brush head. In the old brush, when the metal ferril was cemented to the threading, even a vise would not pry it loose, and in servicing a brush the company frequently had to supply a new head. If the plastic ferril sticks in the threading, however, it can be broken out with a screw driver or a similar instrument, and a new ferril supplied at small cost.

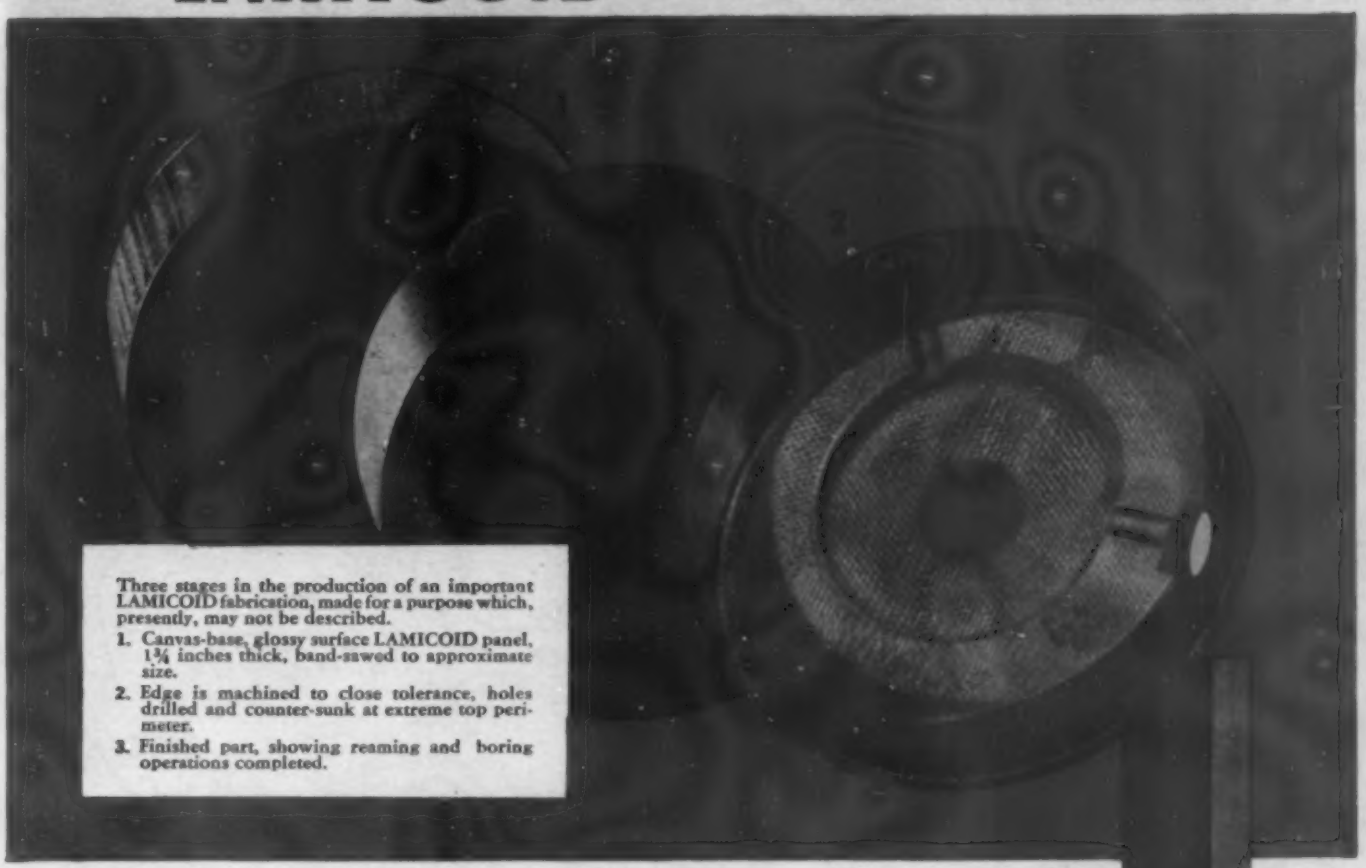
Still another advantage of the new brush is that the phenolic ferril is molded with a tiny anchor on either side to prevent the bristles from turning around in the ferril. Without such anchors, which were difficult to put on the ferrils made of steel or threaded brass tubing, the bristles may turn completely around when an attempt is made to unscrew a ferril that is stuck. This caused many returns on brush tips.

Dried ink pigment acting as a cement caused a great deal of trouble in the old brush, but the only possibility of jamming in the plastic brush is in the small ink chamber in the head of the brush. If pigment does stick here, it is easily cleaned out since the chamber is completely open, while in the old brush the chamber was closed, and difficult of access. Further, the push button of the old brush opened into this chamber, and ink in the chamber often cemented and sealed the valve, with the result that the whole brush had then to be disassembled to clean it out.

Although the new brush has an opening for the push button in the end of the main ink chamber, leakage of ink is prevented by the action of the two leather gaskets (impregnated with wax to make them impervious to the ink) which seal the valve stem and prevent the escape of ink through the push button. The brush can be stood on end without leakage.

The manufacturers feel that the new brush is very successful. They have distributed seven or eight thousand since the first of the year, and a very much larger number have been molded. Of the thousands distributed, only 20 have been returned and of these only a few came back with complaints. They expect to continue the use of plastic after

USE LAMICOID FOR GOOD MACHINABILITY



Three stages in the production of an important LAMICOID fabrication, made for a purpose which, presently, may not be described.

1. Canvas-base, glossy surface LAMICOID panel, 1¾ inches thick, band-sawed to approximate size.
2. Edge is machined to close tolerance, holes drilled and counter-sunk at extreme top perimeter.
3. Finished part, showing reaming and boring operations completed.

...FINER, FASTER FABRICATING

Complexity of design, plus high electrical and mechanical strength requirements, are quickly solved problems when LAMICOID is selected for the job. LAMICOID's properties can be adjusted to suit specific product requirements. By variable selection of fabric or paper bases, laminated with the proper thermosetting resins, it offers to designers and manufacturers a *versatile* fabricating material, with a dimensional stability, and machining qualities which make it superior to metal or wood in countless applications.

LAMICOID stock and fabricating plants are strategically located for fast service...and Mica Insulator Company's Engineering Service is at your constant disposal in exploring LAMICOID's suitability to your fabricating needs. LAMICOID is available in rods and tubes in a wide diameter range and in sheets of 36" x 42" standard size in any specified thickness.

MICA INSULATOR COMPANY

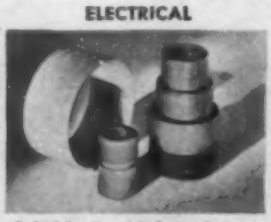
200 VARICK STREET, NEW YORK 14, N. Y.

Chicago: 600 West Van Buren Street • Cleveland: 1276 West 3rd Street • Detroit: Book Building • Cincinnati: 3403 Hazelwood Avenue
Boston: 285 Columbus Avenue • Lamicoid Fabricators, Inc., 3600 Potomac Avenue, Chicago, Ill. • Insulating Fabricators, Inc., 22 Elkins St., S. Boston, Mass.
Insulating Fabricators, Inc., 12 East 12th Street, New York City • The Kirby Company, 13000 Athens Avenue, Cleveland, Ohio

MECHANICAL

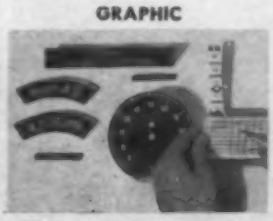
Easily punched, sheared, sawed or machined into parts demanding structural strength and light weight.

ELECTRICAL



Suitable for high and low voltage applications. Low moisture absorption, and low power factor.

GRAPHIC

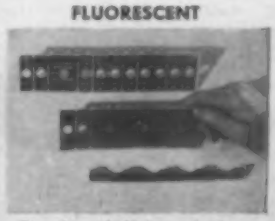


Permanently bonded protection for printed matter of all kinds. Rigid, flexible, opaque or translucent.

ENGRAVING

Sandwich type opaque sheets with colored core. For pantograph engraving or sandblasting.

FLUORESCENT



Panels and dials made from fluorescent LAMICOID fluoresce under ultra-violet light for "blackout" applications.

the war because of its two great advantages over metal—cheapness and light weight. In comparison with their aluminum brush, the phenolic brush is considerably cheaper, and it is very much cheaper than one of their other models fashioned of steel tubing with a bronze head. As the steel tubing could not be fabricated, it was necessary to put a cast head on the brush which could be machined; and the cost of the bronze head alone, with the necessary machining, ran to more than the plastic head and ink chamber together.

The phenolic brush is, of course, infinitely lighter than the steel and bronze brush which was their last model. The steel brush weighs one pound while the phenolic brush weighs six and one half ounces.

Credits—Material: Resinox. Molded by Compression Molding Co. for Diagraph-Bradley Stencil Machine Corp.

Polyfibre

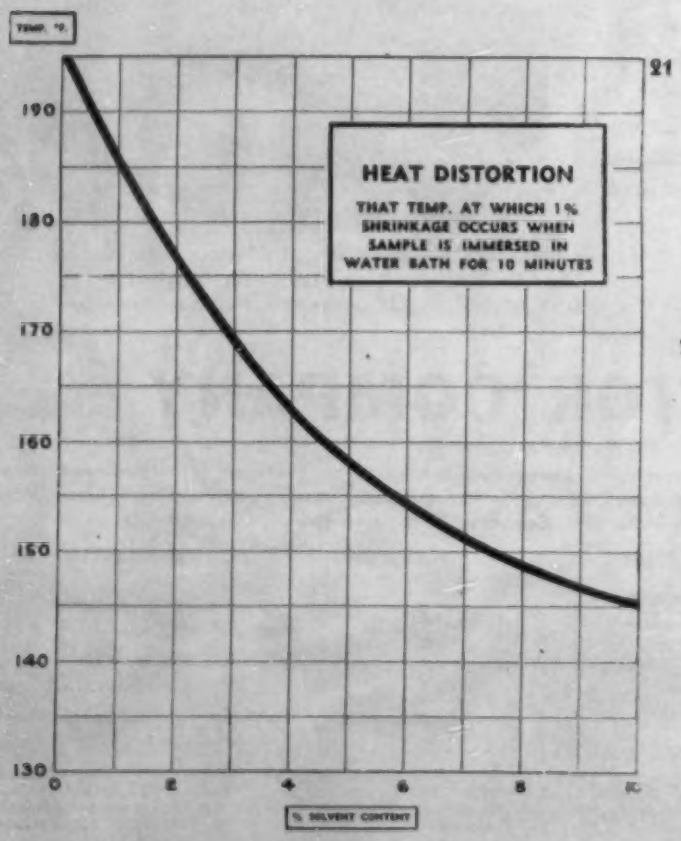
(Continued from page 107) cific gravity (Fig. 19). Since samples vary to some extent with this particular property, a range is shown. Solvent content effects are small except as they are related through molding temperature to specific gravity. The modulus of elasticity, as calculated from these flexural data, ranges from 0.3×10^5 p.s.i. at a specific gravity of 0.3 to 2.0×10^5 p.s.i. for a specific gravity of 1.0.

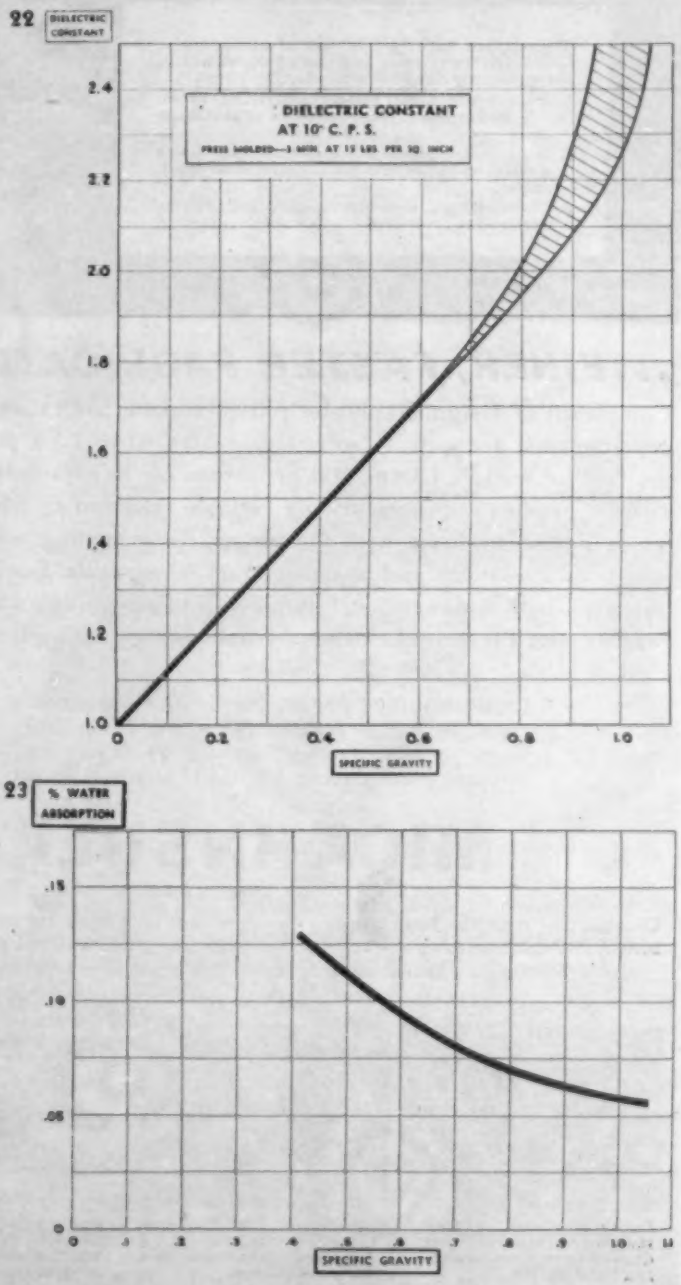
Polyfibre's hardness is related directly to specific gravity (Fig. 20). Tests were made on the Rockwell superficial hardness tester, using a 15 kg. load on a $\frac{1}{2}$-in. ball. Below 0.7 specific gravity, equipment which would give reliable results was not available. As would be expected, press-molded samples of a definite specific gravity give a slightly greater surface hardness than those made to the same density by bag molding. This is a result of the density gradient across the thickness of the sample and is a function of the rate of transfer of heat into the sample during molding.

Heat distortion is one property that is greatly affected by the solvent content of the fiber. At higher temperatures, the solvent acts as a plasticizer. It follows that high solvent content results in a lower heat distortion temperature (Fig. 21). The test which was used had to be somewhat arbitrary but appeared to give results directly comparable to those obtained in the field. Heat distortion is here defined as that temperature at which 1 percent shrinkage takes place when the sample (50 mm. sq.) is immersed in a water bath of controlled temperature for 10 minutes. Curiously enough, specific gravity appears to have little effect on the heat distortion temperatures of the fiber moldings.

Since these fiber moldings are essentially combinations of air and polystyrene, it should follow logically that the moldings would show porosity and absorb large amounts of moisture. Such is strikingly not the case. The curve of

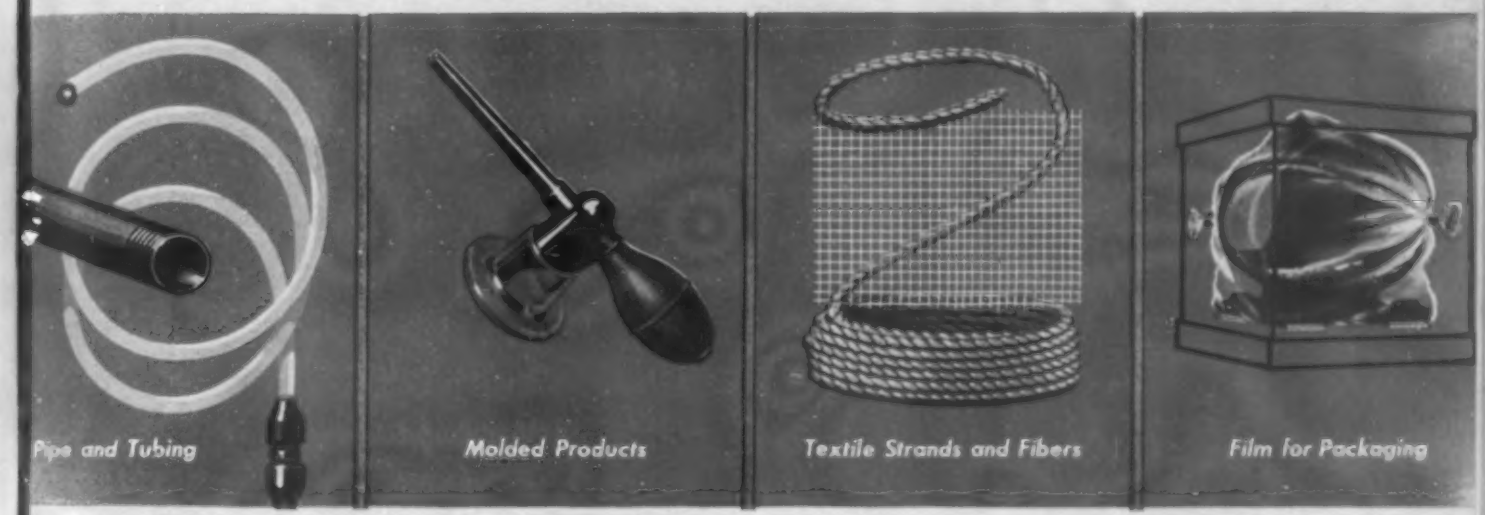
21—*This curve shows the heat distortion of the fiber.* **22**—*A graph of the dielectric constant of the material at 10^6 C.P.S.* **23**—*This curve indicates the water absorption of the fibers: 4.5 percent solvent, A.S.T.M. DS70-42*





In What Forms Can You Use Saran's Chemical-Resistance?

This Dow plastic—inert to a large range of chemicals —can serve you in almost every fabrication form



Virtually everyone in the plastics industry knows of Saran. Some know this versatile Dow development as pipe or tubing; some are familiar with it in molded products, or in extruded form as a monofilament for window-screening, textiles, rope; others know it in film form as the most efficient plastic moisture-barrier for packaging.

But the full importance of Saran's own place in plastics is realized only with the knowledge of the *entire* broad scope of its fabrication possibilities.

Actually, Saran is formulated as a *series* of substances, ranging from a ductile, moderately soluble material to a hard, strong thermoplastic. And throughout this complete range, Saran's toughness and its notable resistance to acids, alkalies and organic solvents are retained to a marked degree.

All of Saran's characteristics can be used in almost every form of plastic fabrication. Perhaps Saran can help you.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

OW PLASTICS INCLUDE

STYRON . . for fabricators producing moldings, extrusions, rod, sheet.

ETHOCEL . . for fabricators producing moldings, extrusions, coatings; available also as Ethocel Sheeting.

SARAN . . . for fabricators producing moldings, extrusions, pipe, tubing, sheet; available also as Saran Film.

SARAN

DOW
CHEMICALS PLASTICS MAGNESIUM
INDISPENSABLE TO INDUSTRY AND VICTORY

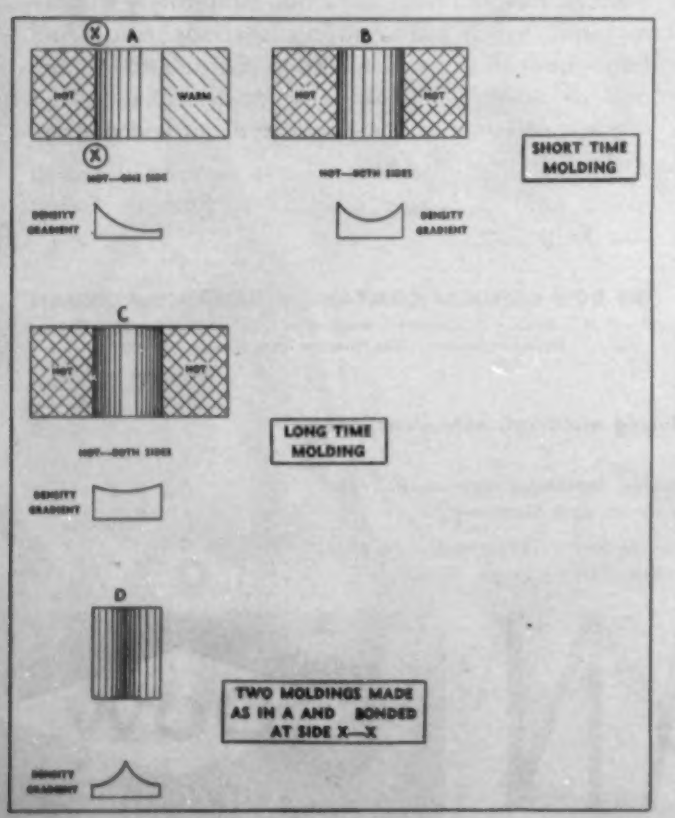
Fig. 23 is based on the A.S.T.M. water absorption test D 570-42 which prescribes 24-hr. immersion in water. After such a test the water absorption of Polyfibre, even in the lower densities, is scarcely twice that of polystyrene's excellently low water absorption at full density.

Tests on the density throughout a fiber molding are a function of the history of the molding cycle. For example, rapidly molded samples show high densities at the surfaces and low densities at the center. The use of one hot platen and one warm one shows a density gradient from high—adjacent to the hot platen—to low—adjacent to the warm one. This phenomenon, shown graphically in Fig. 24, makes it possible to obtain a wide variety of density gradients throughout the moldings. This phase of fiber molding offers another approach to increasingly complex plastic molding applications.

Many of the diversified properties of the fiber moldings have been discussed. Table I clarifies the ranges of properties that are currently available. Molded Polyfibre of 4.5 percent solvent content, ranging in densities from 0.60 to 1.0 g./cm.^{3}, is compared with molded bulk polystyrene.

In conclusion it may be said that the extremely fine oriented thermoplastic fiber, known as Polyfibre, may be molded by unique new methods to give unusual properties. The fact that the material opens new paths to unusual applications through these techniques and properties is borne out by the following new departures made possible by Polyfibre: 1) low-pressure bag molding of large thermoplastic polystyrene parts is now practical. 2) Inexpensive molding equipment may be used. 3) Large moldings of controlled specific gravity ranging up to 1.05 may be made. 4) Controlled specific gravity gradients throughout the molding are possible. 5) Greatly improved impact strengths may be obtained. 6) New low dielectric constants are available. 7) Directional strength properties may be controlled.

24—These drawings show the density of the material through a section as it relates to temperature of platens



New thermoplastic resins

(Continued from page 84)

Although Cerex resins that have heat distortion points as high as 300° F. are available, the top limit for practical moldability in present day injection machines is approximately 250° F. Compression molding is most suitable for the shaping of the more heat-resistant formulations. Resins with a heat distortion range of 195 to 250° F. can be injection molded in a manner similar to that of other thermoplastics such as polystyrene or cellulose acetate. No new appliances or techniques are required for good performance on standard machines or in molds designed for the usual thermoplastics. However, several properties which are inherent in the resins, such

TABLE I.—RESULTS OF 48 HR. BOILING OF COMPRESSION-MOLDED DISKS

Material	*Weight change*	*Thickness change*	*Diameter change*	*Appearance change*
	percent	*percent*	*percent*	
Phenolic, general purpose	+9.6	+9.2	+1.95	Surface roughened
Urea, general purpose	−2.0	−12.9	+2.74	Disintegrated
X-214	+0.8	+1.5	None	No effect

TABLE II.—COMPARISON OF PROPERTIES OF CEREX AND POLYSTYRENE[a]

	Cerex	*Polystyrene*
Injection molding temp.,		
Cylinder, ° F.	370–500	400–450
Mold, ° F.	170–250	150
Specific gravity	1.07	1.05–1.07
Flexural strength, p.s.i.	13,000	8000–10,000
Deflection, in.	0.169	0.110–0.130
Impact strengths,		
Charpy-notched, ft. lb./in.	0.46	0.30–0.37
Izod-notched, ft. lb./in.	0.40	0.30–0.40
Izod-unnotched, ft. lb./in.	3.48	2.64
Distortion temp. std., ° F.	212–230	168–176
Rockwell hardness	M100	M80–M90
Dielectric strength, v./mil	510	500–700
Dielectric constant,		
60 cycles	....	2.5–2.6
1000 cycles	2.72	2.5–2.6
1 megacycle	2.76	2.5–2.6
Power factor,		
60 cycles	....	0.0001–0.0003
1000 cycles	0.0024	0.0001–0.0003
1 megacycle	0.0024	0.0001–0.0003
Arc resistance, sec.	69	61
Burning rate	Slow	Slow
Water absorption, A.S.T.M.		
24 hr., percent	0.30	0.05
Effect of,		
Weak acids	None	None
Strong acids	Oxidizing acids attack	Oxidizing acids attack
Weak bases	None	None
Strong bases		
Solubility	Soluble in arom. and chlorinated hydrocarbons	Soluble in arom. and chlorinated hydrocarbons
Clarity	Amber transparent	Transparent
Color possibilities	Extensive	Unlimited

[a] Values determined under appropriate A.S.T.M. test methods.

The Machine of Tomorrow— TODAY!

Sav-way SPITFIRE

ELECTRO-HYDRAULIC INTERNAL GRINDER

Modern Functional Design Throughout

★

Neoprene Insulated

★

Famous Gold Seal Spindle

★

Electrically-Operated Diamond Wheel Dresser

Ready ahead of time—the Sav-Way MH-1 combination hand and electro-hydraulic internal grinder. 5/32″ minimum table stroke! Gatling gun table speed, through the use of aircraft-type micro-limit switches and solenoid-operated valves. Electrical, automatic, adjustable cross feed. Dozens of outstanding features! As up-to-the minute as the plastics industry, itself! It's a postwar machine—ready now to help speed today's war production! Its low cost will surprise you.

Sav-way INDUSTRIES
Machine Tool Division
BOX 117, HARPER STATION, DETROIT 13, MICH.

Send for Actual Photographs, Specifications, and Prices

BUILDERS OF HAND AND HYDRAULIC INTERNAL GRINDERS · PRODUCERS OF GOLD SEAL SPINDLES
PLUG GAGES · MICROMETER CHECKERS · PRECISION AIRCRAFT, AUTOMOTIVE, AND ORDNANCE PARTS

as high softening point, low heat conductivity and a tendency to decompose when maintained at high temperatures, do require close attention. Generally speaking, injection cylinder temperatures will vary between 400 to 500° F. The use of higher injection temperatures must be avoided or serious discoloration may be encountered. Injection mold temperatures must be maintained between 180 to 220° F. to avoid premature setting of the resin during flow but, because of the high softening point of the plastic, parts may be ejected safely at these high temperatures. Usually, cycle timing is similar to that used with other injection materials.

Although the compression molding of Cerex is not recommended for production purposes, experimental parts may be compression and transfer molded. Detailed information on the injection and compression molding of the material can be made available upon application. Intensive work is continuing on the development of further information on the resins, and pertinent data will be made available to the plastics industry as it is developed.

Artificial eyes

(*Continued from page 89*) new. Glass, in spite of excellent care, becomes rough through handling and attack by body acids. In consequence, it needs to be replaced in from one to two years. At the same time, the body acids discolor glass so that the eye takes on a discouraging, gray appearance. In contrast, plastic does not change in color. The plastic eye may be worn day and night, while it is common practice to remove a glass eye at night, which under many circumstances is embarrassing for the wearer.

8—The plastic eye is etched after the implanting of the iris and veining so that it will conform to the shape of the eye socket. Then it is polished to insure comfort

When that soldier from the South Seas is back at home, one of his eyes destroyed by a shell fragment, his injury will almost defy detection if he is provided with a plastic eye to match exactly his natural one. It is Dr. Noles' hope that enough artisans can be trained in this new use of plastics so that individually made eyes may be made available to every person who desires one. Plastic eyes are also being made at the present time by Paul Gougelman, the Chicago affiliate of Mager and Gougelman.

A new dielectric

(*Continued from page 93*)

The main disadvantages of the three insulations C, D and E were that they deformed at temperatures between 80 and 100° C.—some more than others—and generally lacked heat resistance at continuous temperatures of 75° C. and higher. This could probably be traced to the fact that the rubber or cyclized rubber was not chemically stable, and also to the peculiar phenomenon that polyisobutylene was not compatible with the polystyrene but was held in the mixture by the third ingredient and showed a tendency to separate, sometimes during extrusion and sometimes when the cables were heated in a bent position.

It was not uncommon to make cable which looked fine at first but cracked apart on the reel two days later. Probably the best results could be traced to the technique of extruding the insulations at such a temperature that all the ingredients had similar plastic flow properties. A blend of 60 parts of I.C.I.-type unstabilized polyethylene and 40 parts of polyisobutylene (100,000 molecular weight) was made during this transition period with little if any improvement over the other types in common use. The distortion temperature was well below 100° C. and the power factor was increased slightly by the hot milling of the mixture.

Wherever polyisobutylene-blend insulations performed satisfactorily, polyethylene insulations have proved superior and have gone on to uses thoroughly unsuited to the former insulations. Among the severe conditions which have been encountered could be listed exposure to temperatures from 75 to 100° C., both of short duration and continuous, that show little effect on the polyethylene but cause the deterioration, deformation and failure of the previous cable dielectrics. Prolonged exposure to high voltage and water has also been found to affect polyethylene only slightly. Polyisobutylene-blend insulations, on the other hand, suffered from rather poor dielectric strength, were attacked by ozone and showed greater power-factor changes on exposure to water.

Nothing has been said about cables with part air and part

TABLE III.—DIELECTRIC PROPERTIES OF HIGH-FREQUENCY INSULATIONS

Insulation	*Dielectric constant (1 MC)*	*Power factor (1 MC)*
(A) Rich rubber (vulcanized)	2.4–2.7	0.002 –0.006
(B) Rubber—polyisobutylene (vulcanized)	2.4–2.6	0.002 –0.005
(C) Rubber—polyisobutylene—polystyrene	2.3–2.5	0.0008–0.002
(D) Cyclized rubber—polyisobutylene	2.3–2.5	0.0005–0.001
(E) Cyclized rubber—polyisobutylene—polystyrene	2.3–2.5	0.0003–0.001
(F) Polyethylene	2.2–2.4	0.0002–0.0005

NEW MIRACLE SAW

CUTS PLASTICS AND LAMINATES

Faster!

A stumbling block to industry's use of more plastics during the important war years has been the difficulty of cutting and shaping them rapidly.

Now, that problem is solved—the new DoALL Buttress Band Saw, developed in the DoALL Research Laboratory handles every kind of plastic. And—it fits any band sawing machine.

NO SHARPENING REQUIRED
Use the DoALL until worn out, then insert a new saw.

NITRO CELLULOSE

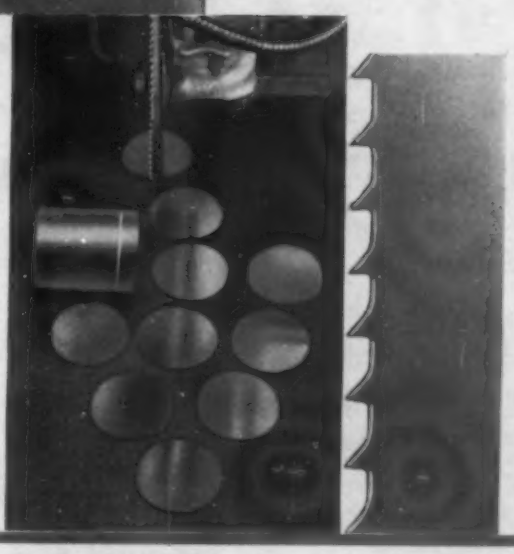
17 pieces of 2" diameter bar stock were cut per minute with the DoALL Buttress. Each cut was true, uniform and parallel—no gumming or burning. The saw kerf thickness was only .045" compared with .125" by former method. Think of that saving in material alone!

SARAN

3" thick material was cut with the DoALL Buttress at the rate of 20 square inches per minute.

STYRALOY

9/16"—cut at the rate of 120 square inches per minute. An exceptionally smooth finish was obtained.



DoALL Buttress
THE NEW WIDE-SPACED HARD TOOTH SAW
TRADE MARK REG.

The New, Wide Spaced, Hard Tooth Band Saw

The spectacular new band saw that has been tried out recently in a dozen large aircraft and other war plants with unheard-of-before results. Not only does smoother cutting, but does the work in 1/10 to 1/5 the former time.

IMMEDIATE DELIVERY from all our Supply Points.

DoALL

INDUSTRY'S NEW SET OF TOOLS

Write for Literature and Prices

THE DoALL COMPANY

1219 Thacker St. Des Plaines, Ill.

Sales & Service Offices: Baltimore, Boston, Chicago, Cleveland, Denver, Detroit, Erie, Houston, Indianapolis, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Orlando, Philadelphia, Pittsburgh, Rochester, Rockford, St. Louis, San Francisco, Seattle, Toledo, Tulsa, Wichita

solid insulation. Many intricate cable designs have been worked out using filaments (60, 61) and beads of polystyrene, but they all result in weak mechanical cables—especially under impact and elevated temperatures—and in nearly all cases were subject to some moisture leakage when exposed to the weather. Due to the flexible nature of the material, cables made with part air and part polyethylene dielectric are much better in these two respects.

At present polyethylene is being supplied for cable insulation under a raw material specification which includes tests for tensile strength, elongation, flow and recovery under heated conditions, specific gravity, percent and type of anti-oxidant, dielectric constant, power factor and cold-temperature impact. At the moment, the specification (in the interests of quantity production of cable at uniform quality) is somewhat restrictive on the manufacturers of polyethylene and, consequently, on the fabricators. The material can be made to resemble the early I.C.I. material, which has certain advantages, or it can be made tougher. A tougher polyethylene presents more problems in forming and extruding, but may eventually find important uses which would justify development in handling methods.

Bibliography

[1] E. Bamberger and F. Tschirrer, Ber. *33*, 95 (1900).
[2] H. Staudinger, M. Brunner and W. Feist, Helv. Chim. Acta *13*, 827 (1930).
[3] F. Fischer and H. Tropsch, Ber. *60*, 130 (1937).
[4] H. Pichler, Angew. Chem. *51*, 412 (1938).
[5] H. Mark and R. Raff, High Polymers (*3*), "High Polymeric Reactions," p. 233, New York (1941).
[6] V. N. Ipatieff, J. Russ. Phys. Chem. Soc. *38*, 63 (1906); J. Chem. Soc. *92I*, 5 (1907); J. Russ. Phys. Chem. Soc. *43*, 1420 (1912).
[7] E. W. Fawcett, Brit. Pat., 336,324 and 350,513.
[8] H. H. Storch, Ind. Eng. Chem. *26*, 56 (1934); J. A. C. S. *56*, 374 (1934).
[9] E. W. Fawcett et al., Brit. Pat., 471,590 (1937) and 474,426, Can. Pat., 388,355.
[10] E. W. Fawcett et al., U. S. Pat., 2,153,553 (1939).
[11] M. W. Perrin et al., U. S. Pat. Appli., Serial No. 157,810 (filed 1937).
[12] M. W. Perrin et al., Brit. Pat., 497,643 (1938).
[13] E. W. Fawcett, Brit. Pat., 481,515 (1938).
[14] E. W. Fawcett, Brit. Pat., 492,322 (1938).
[15] S. S. Khain and V. P. Zaitseva, Chimie and Industrie *40*, 478 (1938).
[16] D. N. Andreev, Bull. acad. sci. *1938*, 1039, 1052; Chem. Abstr. *33* (16), 6575 (1939).
[17] Ya. T. Eidus, Chem. Abstr. *33* (9), 3269 (1939).
[18] Sixt, U. S. Pat., 2,183,154.
[19] H. D. Burnham and R. N. Pease, J. A. C. S. *62*, 453 (1940).
[20] V. Konaka, J. Soc. Chem. Ind. Japan *43*, Suppl. 330 (1940).
[21] L. M. Ellis, U. S. Pat., 2,212,155 (1940).
[22] H. C. Crafton, Jr., "Synthetic Materials as Insulation on Electrical Conductors," Paper presented before Nat'l Res. Council, Williamsburg, Va., Oct. 1941.
[23] G. N. Everest, Iron and Steel Eng., July (1943).
[24] J. Veit, Electrical Times, July (1943).
[25] E. D. Youmans, Elec. World, Aug. (1943); ibid., Sept. (1943).
[26] A. M. Ross, Gen. Elec. Rev., April, 212 (1943).
[27] C. A. Finkel, "Synthetic Insulations for Cables," Paper presented before North Eastern District, A. I. E. E., Boston, Mass., April 1944.
[28] C. W. Brunn, Trans. Faraday Soc. *35*, 482 (1939).
[29] C. S. Fuller, Chem. Rev. *26*, 143 (1940).
[30] "Symposium of Dielec. Props. of Matter," Chem. Rev. *19*, 163 (1936).
[31] Dielectrics, *XI*, Annals N. Y. Accid. Sci., April, 289 (1940).
[32] R. M. Fuoss, J. Chem. Ed. *19*, 190, 221 (1922); in R. E. Burk and O. Grummitt, Chem. of Large Molecules, p. 191, New York (1943).
[33] S. O. Morgan and W. A. Yager, Ind. Eng. Chem. *32* (1), 1319 (1940).
[34] S. Hukutomi, Plastics Ind. (Osaka) *9* (4), 2 (1940).
[35] G. Gettusso, Electtrotecnia *27*, 310 (1940).
[36] H. M. Richardson, Elec. World, April, 67 (1943).
[37] V. E. Yarsley, The Electrician *128* (3326), 184 (1942).
[38] W. G. Wearmouth, Journ. Sci., Instr. *19* 129 (1942).
[39] J. W. Shackleton, Modern Plastics *21* (6), 99 (1944).
[40] H. Mark, Ind. Eng. Chem. *34* (11), 1343 (1942).
[41] H. Mark, Am. Scientist *31* (2), 97 (1943).
[42] T. S. Carswell and T. Alfrey, Elec. World, June, 69 (1943).
[43] W. J. Tucker, Elec. Rev. *129* (3341), 625 (1941).
[44] L. A. Matheson and R. F. Boyer, "Synthetic-Plastic Electrical Insulation—1942," in Nat'l Res. Council-Rpt., Bell Telephone Labs., p. 37 (1943).
[45] F. H. Muller, Kolloid-Z. *100*, 355 (1942).
[46] "Elec. Props. of Plastics," Prod. Eng., Mar., 165 (1943); "Plastics for Present and Postwar Products," ibid., Sept. 1 (1943).
[47] Plastics Catalog, Plastics Catalog Corp., New York (1944).
[48] F. E. Wiley, Modern Plastics *20*, 80, 134, 136 (1943).
[49] "Tech. Data on Plastic Materials," Plastics Materials Mfrs. Ass'n, Washington, D. C. (1943).
[50] T. S. Carswell and R. F. Hayes, Modern Plastics *19*, 68 (1942).
[51] A. T. McPherson, in C. C. Davis and J. T. Blake, Chem. and Tech. Rub., p. 537, New York (1937).
[52] K. H. Meyer, High Polymers, *IV*, "Natural and Synthetic High Polymers," p. 178, New York (1942).
[53] L. A. Wood, Proc. Rubber Tech. Conf., London, p. 933 (1938).
[54] L. A. Wood, India Rub. World *102* (4), (1940).
[55] M. L. Skeler, G. G. Winspear and A. R. Kemp, Ind. Eng. Chem. *34* 157 (1942).
[56] C. S. Fuller et al., J. A. C. S. *62*, 909 (1940).
[57] R. L. Taylor, D. B. Hermann and A. R. Kemp, Ind. Eng. Chem. *28*, 1255 (1936).
[58] C. S. Whitby, in C. C. Davis and J. T. Blake, Chem. and Tech. Rub., p. 61, New York (1937).
[59] K. H. Meyer and A. van der Wyck, Helv. Chim. Acta *20*, 1313 (1937).
[60] Klimmer and Franz, U. S. Pat., 2,116,268, May (1938).
[61] Unterbusch and Franz, U. S. Pat., 2,189,090; 2,189,091, Feb. (1940).
[62] J. C. Swallow, Endeavour, *III* (9), 26 (1944).

Insulating wire

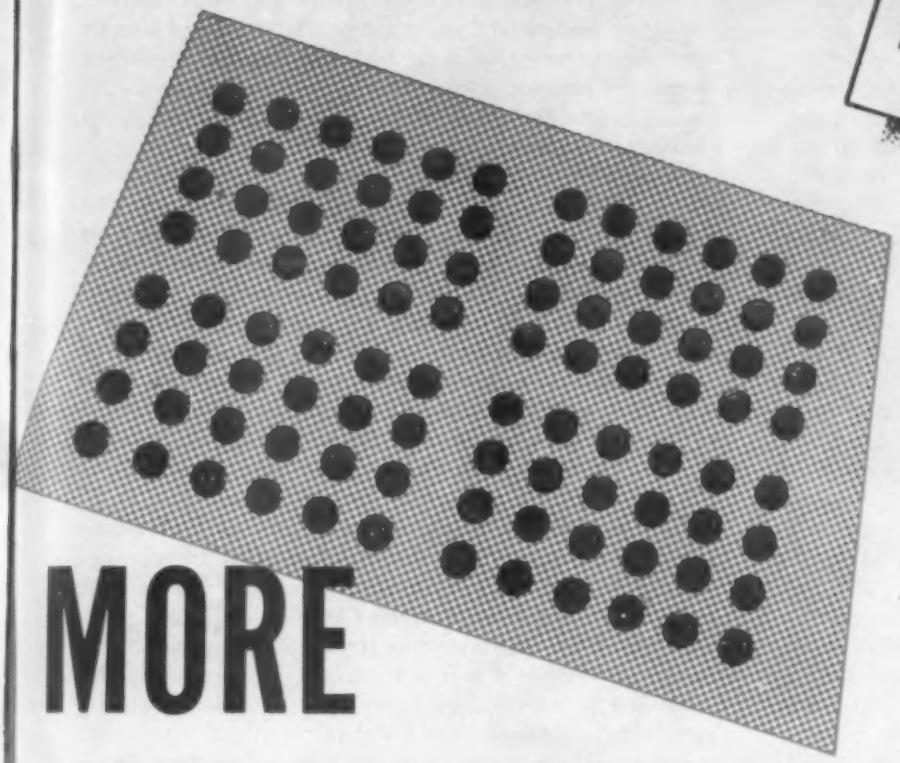
(*Continued from page 100*) tests seem to indicate that deformation of wall thicknesses of wire at that temperature results in no loss of dielectric strength. Chemically, the material is stable up to much higher temperatures. This plastic has low moisture absorption. In equilibrium at 20 percent relative humidity it takes up only 0.4 percent of its weight in moisture while at 95 percent relative humidity it takes up 1.7 percent. This characteristic and the plastic's chemical stability make the material suitable not only for primary insulation but for use as a cable lacquer.

The insulation resistance of properly constructed wire made with cellulose acetate butyrate sheeting or with this same sheeting coated with modified vinyl acetate, is generally higher than most insulating materials in common use. This fact was particularly evident at the end of the life cycle tests conducted in compliance with both Aircraft and Signal Corps.

Table I.—Properties of Kodapak II

Physical	
Specific gravity	1.20
Elongation,	
Length	Not less than 40 percent
Width	in both directions
Tensile strength, kg., 15mm. × 0.0016 in.	
Length	3.5
Width	3.0
Moisture transmission, mg./cm.²/hr.	1.00
Oven shrinkage, 130° F., 1 wk., percent	0.5
Moisture absorption,	
20 percent r.h., percent by weight	0.40
40 percent r.h., percent by weight	0.55
60 percent r.h., percent by weight	0.90
80 percent r.h., percent by weight	1.4
95 percent r.h., percent by weight	1.7
Electrical	
Voltage breakdown, short time, v./mil,	
−50° F.	4300
0° F.	4000
70° F.	3500
212° F.	3000
270° F.	2000
After soaking in water,	
70° F.	3400
Dielectric constant, 1000 cycles	2.5 approx., may be higher
Power factor, 1000 cycles, percent	1.1

NUMBER 13 IN A SERIES OF EDUCATIONAL ADVERTISEMENTS ON TRANSFER MOLDING



MORE MOLDINGS PER CYCLE

TRANSFER MOLDING allows an unusual latitude in the number of thermosetting moldings produced in a given cycle. By transforming the plastics into a molten state, the TRANSFER MOLDING process enables the material to be flowed into a great number of cavities.

The pieces shown on this advertisement are an illustration of this point. The 96 uniform moldings were made in a *single* cycle on a *single* press. They are made of phenolic material.

TRANSFER MOLDING is the best way to

- Handle inserts—metal, glass, ceramic
- Mold high-impact materials
- Mold unsupported cores
- Achieve maximum dimensional accuracy
- Reduce trapped gases
- Lower mold costs
- Lengthen mold life
- Increase molding speed
- Reduce finishing costs
- Improve uniformity of cure regardless of cross-section
- Save material by eliminating flash
- Get practical solution to difficult molding problems

—on thermosetting plastics.

The production of more pieces per mold per cycle results in definite economies and in speeding up the molding process. It is another reason for the increasingly wide adoption of TRANSFER MOLDING in the plastics industry.

SHAW INSULATOR CO.

IRVINGTON SHAW NEW JERSEY

1892

specifications. In addition, the dielectric breakdown strength of the material does not suffer materially from long exposure either to heat or humidity.

The dielectric breakdown per mil of thickness of the insulating material in sheet form is relatively high as is the insulation resistance—especially under increased humidity and after immersion in water. One manufacturer of hook-up wire requires that all material meet the following tests: minimum average insulation resistance, 50,000 megohms; minimum single reading, 30,000 megohms; chloride content, maximum —0.020 percent reported as chlorine.

Where space is a factor, as it is in so many cases, a plastic that is applied as a tape is the surest way of obtaining safety with the use of a minimum amount of insulating material. Tests have indicated that tape walls of half the thickness of extruded walls are satisfactory. Wire insulated with cellulose acetate sheeting coated with modified vinyl acetate is always "center-sealed"—that is, it has a uniform amount of insulation around the conductor.

For convenient reference, the essential physical and electrical properties of this sheeting as determined by its manufacturer are given in Table I.

This new plastic, pioneered for peace, has proved itself a potent weapon for war. When peacetime production of radio, television and electronic equipment is resumed, it is expected that the outstanding properties of this material will insure its continued use as wire insulation.

Credits—Material: Lexel. Adapted by Dobeckmun Co. from Kodapak II.

Maximum price regulation

(***Continued from page 79***) based upon an estimated use of 50 lb. of molding material and a production of 50 pieces per hour. This order is repeated during Feb. 1944, with delivery being made on April 5, 1944. The molder has thereby completed one production run after the effective date of the new plastics products regulation. Examination of the records discloses that 60 lb. of material were consumed instead of the expected 50 pounds. Also that only 40 pieces per hour were finished instead of the estimated 50 pieces. Should the purchaser seek to re-order part No. 101, the Oldtyme Plastics Corp. may quote a price based upon its production experience, applying its approved formula and rates to determine its new maximum price. This higher price must be reported to the Office of Price Administration, Washington, D. C. Should the reverse have been true, and less material consumed and greater production realized, the purchaser must be given the benefit of the lower price resulting from this recomputation, but no report need be filed. No additional recomputation is permitted on future re-orders for part No. 101.

How about the Newcomer Plastics Co. which started in the business of producing plastics products in Jan. 1943? They must establish a price determining method at once, and must report such method to the Office of Price Administration, Washington, D. C., for approval. This price-determining method shall be reasonable in the light of the operations being —or to be—performed. In order that both the Oldtyme Plastics Corp. and the Newcomer Plastics Co. may compete on an equal footing, all rates proposed in the reported formula must be in line with March 31, 1942, rates for the locality in which the manufacturing is to be performed.

Maximum Price Regulation 523 also applies to sales by the molder or fabricator of dies, molds or special tools which are sold in connection with the sale of a plastics product. It is a fact, historically, that molders seldom showed a profit from the operation of their tool rooms. The regulation follows the practice of the industry by establishing as the maximum price the *cost* of the die, mold or special tool to the plastics manufacturer.

Provision is made in the regulation for individual price adjustments in the case of essential producers of essential plastics products. These adjustments may affect the price of a specific item, or the application may seek relief because of general over-all hardship. Such an application might be filed to seek an increase in the maximum price of an item whose price had been established because of a sale during the base period. Such an application would be in order in an attempt to seek relief where a base period pricing formula would result in maximum prices below current costs. In the case of a manufacturer whose annual sales exceed $200,000, such application must be filed in Washington, D. C. In the case of a manufacturer whose annual sales are less than $200,000, the application shall be filed with the regional office of the Office of Price Administration located in the same region in which the manufacturer's business is located.

To aid in the enforcement of this regulation, every manufacturer subject to it is required to keep certain records for inspection by the Office of Price Administration. Such records include complete and accurate records of every sale; complete records of published price lists and discount sheets; prices charged during the period Jan. 1 to March 31, 1942; labor rates in effect on March 31, 1942; factory overhead rates, detailed cost estimate sheets, etc.

From the foregoing it may readily be seen that the objective of this regulation has been to stabilize maximum prices for the plastics industry at a level which is in line with March 31, 1942, prices. Before establishing these maximum prices, meetings were held with the Plastics Industry Advisory Committee and with representative molders and fabricators. Their advice and suggestions are reflected in a number of the provisions of the regulation.

It is my belief that this regulation, which is a result of the joint efforts of the Office of Price Administration and the industry, provides a sound and equitable means of establishing maximum prices for the plastics industry.

High-, low- and no-pressure

(***Continued from page 82***)

Types of molds

Each class of laminating requires specific consideration as to the type of material suitable for mold construction. High-pressure laminates are usually produced on hardened steel molds. Hence the price is generally high and not easily amortized unless a considerable number of units are required. Low-pressure laminates may be produced on most of the cast-type metal molds—cast aluminum, cast Kirksite, cast brass or bronze, etc. This results in considerable mold economy. With proper maintenance, the minimum life of the mold should be several thousand parts. Longer life and better finish can be attained by the hard chromium plating of the cast molds which may then be finished by simple scraping and polishing.

No-pressure molds may be constructed of cast plaster, concrete, phenolic resin or from wood or metal. The picture is somewhat complicated by the exothermic nature of most

SMOOTH BEARINGS for ROUGH CROSSINGS

Another example of versatile Micarta *at work*

The flat bottom that enables LCI (Landing Craft Infantry) to crawl up close to enemy beaches, isn't exactly an asset in a rough ocean crossing. Without a keel to steady them, they pitch and toss with every ripple. That's tough on stern tube bearings.

But these small boats (the smallest of the Navy's fleet to cross the ocean under their own power) are still fit to fight after a stormy ocean hop. The stern tube bearings on these sturdy craft are Westinghouse Micarta—the tough, versatile plastic. Here's why:

MICARTA has high impact strength, will absorb the severe shocks encountered in heavy seas. It will not split or crack.

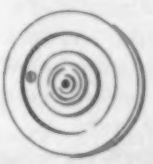
MICARTA wears evenly—in many ships has multiplied bearing life as much as 400 per cent.

MICARTA is unharmed by salt water and reduces galvanic action. Water is its best lubricant.

Micarta marine bearings, as well as countless other applications of Micarta, are produced by Westinghouse—largest laminators of industrial plastics. If these examples of Micarta at work suggest answers to problems you have still to solve, consult Westinghouse Micarta engineers and the new Micarta Data Book B-3184-A. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-06344A

BOMB RACKS
have been successfully molded of Micarta . . . furnish an excellent example of Micarta's strength and the skill of Westinghouse engineers in intricate molding assignments.

PUMP RINGS
made of Micarta do not soften in service, wear slowly, will not score cylinder walls, and are inert to mildly corrosive liquids or gases.



PULLEYS
of Micarta save weight, resist corrosion, extend life of both pulley and cable. Many other new applications are now being discovered.

Westinghouse
Micarta
THE INDUSTRIAL PLASTIC

of the thermohardening resins. Relatively inexpensive molds must be metal faced by capping with formed sheet metal, by electroplating or by metal spraying and finishing. The metal facing facilitates the "piping" away of the exothermic energy. If this precaution is not taken, some of the residual monomer will be gradually raised in temperature to above the boiling point and blisters will occur. This, of course, results in the rejection of the part.

Cure cycles

The number of pieces which can be molded per day per mold is directly dependent on the cure cycle. High- and low-pressure laminates can be cured in a 3 to 5 min. cycle at a temperature of 300–340° F. for thicknesses up to $^1/_8$ inch. The dry "B" stage impregnated sheets are loaded directly into the mold, the mold closed and the pressure maintained for the duration of the cure time. In some of the high volatile content low-pressure laminates it is necessary to breathe the mold momentarily to permit the excess solvent to escape, thereby preventing blistering. The laminates may be hot released without cooling the mold.

No-pressure laminates usually require from 30 min. to 8 hr., depending upon the thickness of the laminate and the massiveness of the mold. Since non-metallic molds are frequently used, considerable time is required to bring the mold to the initial curing temperature. Thermohardening resins are generally cured using a "cycle" cure. This means starting the cure at a relatively low temperature, say 140° F., and gradually raising it to 240° F. This procedure serves several purposes: 1) high heat would cause uncontrolled flow of the resin due to a high degree of fluidity, and 2) the monomer might vaporize and cause bubbles to form. The gradual increase in temperature further facilitates more uniform activation of the constantly diminishing amount of benzoyl or lauroyl peroxide catalyst that is present. Flat sheet laminates made with thermohardening no-pressure resins may be produced continuously in a conveyor-type oven using doctor blades to scrape off excess resin after impregnation and pressure rolls to force adjacent laminae into contact with one another. Again, a separator must be applied to both surfaces of the laminate to prevent poisoning of the resin by contact with air.

Conclusions

Three important techniques—high-, low- and no-pressure—are available to meet the various production and design requirements involved in the production of plastic laminates. Excellent materials, supplied by a number of materials manufacturers, are available for each type. At the present time the production advantages appear to be with the low-pressure laminating process because of lower material cost, shorter cycle and approximately equal tooling cost.

Except for the higher investment in presses as against ovens and vacuum equipment, there is considerable evidence that where one part only is required the cost is approximately equal for the low-pressure and the no-pressure method. This is partially based on the fact that the first part produced by the no-pressure method is seldom acceptable. Several attempts and a number of materials are required to work out experimentally a satisfactory cycle. The cost of cast tooling is approximately equal to the cost of metal-faced non-metallic molds which are used in low-pressure and no-pressure laminating, respectively. Where high production is required, the greater economy and consistency of properties achieved by high-pressure laminating are still paramount.

Gun butts

(Continued from page 87) results in the evaporation of too much moisture and a consequent deterioration in the flow characteristics of the material.

The three charges of material are placed in the heated transfer pots where they are allowed to remain for from 30 to 40 sec. before pressure is applied. This procedure results in a certain degree of preheating without deterioration of the plastic. Production men believe that high-frequency preheating would speed the molding cycle by 50 percent. However, up to the present time, units large enough to handle the size preforms required for this job have not been obtainable.

The actual molding cycle is approximately 7 minutes. This permits a maximum of $8^1/_2$ heats per hour per press. At the completion of the cycle the press opens automatically (Fig. 5). Knockout pins attached to three knockout bars which can be seen extending from left to right in the center of Fig. 5, have just pushed the molded gun butt and the three core pieces from the lower half of the cavity. A considerable amount of flash is visible in the transfer pots.

Upon removal from the mold the plastic gun butt is placed in a chase where the cores are carefully removed, then immediately plunged into cold water to prevent any possibility of the part distorting while it is still hot. When the mold and pot cavities have been blown out, the same cores are inserted in the mold and the pots recharged.

The core-removing apparatus (Fig. 6) comprises a holding jig that grips the gun butt and three hand levers mounted so that they engage the three core plugs. By actuating these levers, all three plugs can be easily withdrawn from the part.

The finishing operations involve the removal of all runners and the finishing off of the gates. A wet sander (Fig. 7) completely removes the flash and all traces of the split line. Phenolic material with a shredded fabric filler has always been a problem to the molding industry inasmuch as parts molded of the material always seem to have a fuzzy surface. Use of wet sanding has eliminated to a great extent the difficulty encountered in cutting the fabric sharp, clean and even with the surface of the molded piece, and has resulted in a fine, smooth finish.

Since the original high gloss and dark mahogany color of the part must be altered to a smooth, dull finish, the gun butts are sand blasted and immersed in a bath of non-volatile oil. A semi-automatic machine has been developed which sand blasts these parts with amazing efficiency and speed. The gun butt is placed on a close-fitting arm, the spindle started and the piece fed into the blasting chamber. Here it is revolved so that every exterior surface is directed into the blast. The entire operation takes less than a minute—the production rate being 72 parts per hour. Finally, four holes are drilled and tapped in the gun butt stocks.

Before the parts can be shipped they must undergo rigid inspection, all openings being carefully gaged. After a final bath in an adhering oil the stocks are packaged in specially designed cartons holding either 8 or 24 butt stocks.

Among those responsible for the successful development of the gun butt are Edwin G. Hempel, designer and experimental engineer, Firestone Rubber and Latex Products Co.; Major A. E. Benson, formerly in charge of Development and Research, Experimental Lab., Springfield Armory; and his assistants, Lieut. W. E. Diffley and Herman Hawthorne.

Credits—Material: Bakelite and Resinox. Molded by Firestone Rubber and Latex Products Co. for U. S. Army. Molds by W. & A. Tool Co.

NORTON LABORATORIES (INCORPORATED)

CUSTOM MOULDERS OF SYNTHETIC PLASTICS
BAKELITE DUREZ

LOCKPORT, N.Y.

NORLOC NOVELTIES

ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, FIRES, ACCIDENTS OR CAUSES BEYOND OUR CONTROL.
CONTRACTS WITH AGENTS NOT VALID UNTIL APPROVED BY AN OFFICER

July, 1944

Dear Constant Reader:-

Let me tell you about some people. Because after all, that is what we are - just a group of people.

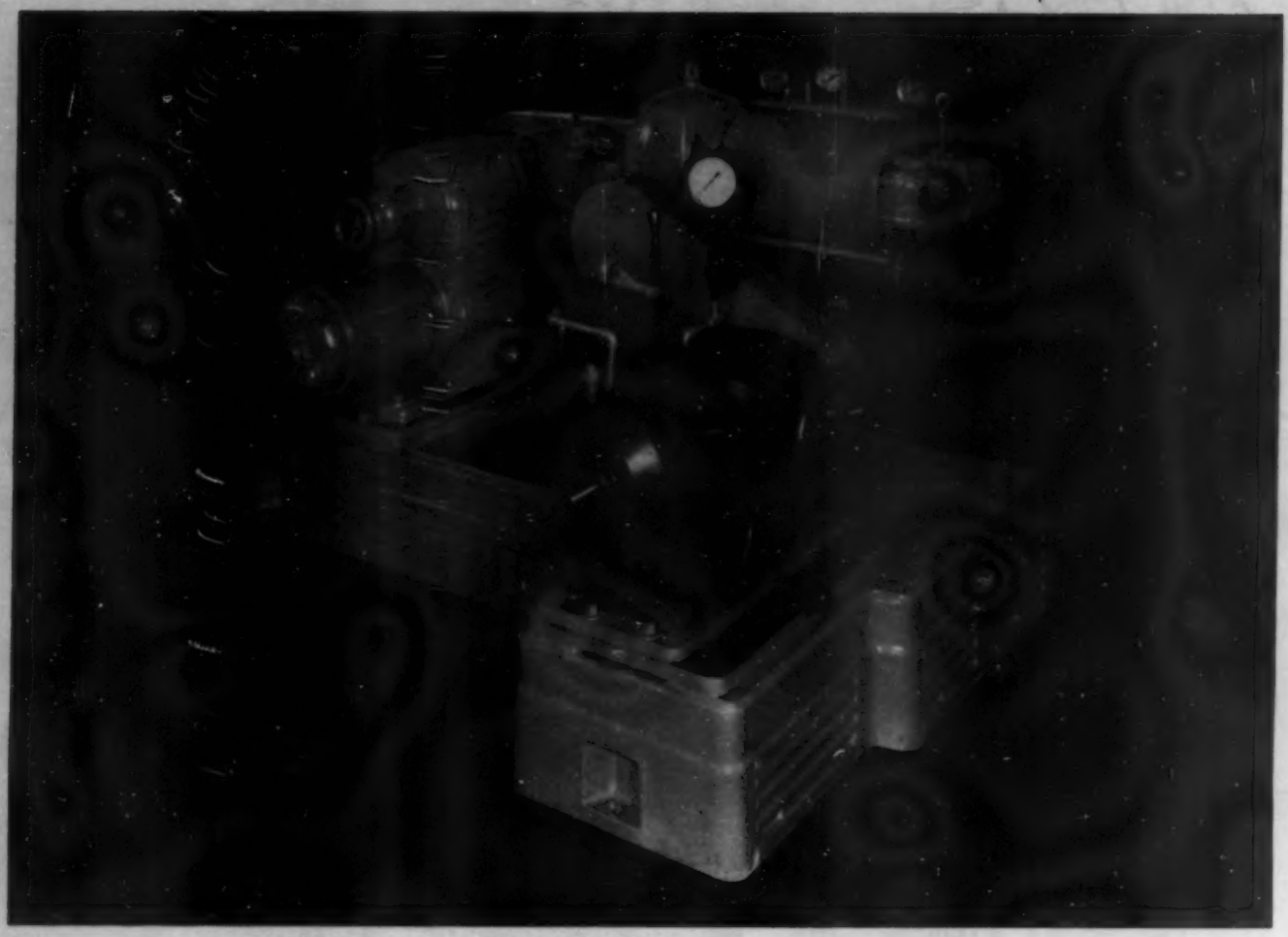
Our plant is just another building (albeit with a few little quirks of our own). Our machines are fairly standard in the plastics industry. But it is when you get to the human factor - the one that really makes the wheels go round - that you find Norton just a little bit different than the average molder.

We have been around this business long enough to have made most of the standard mistakes - and even a few that are peculiarly our own. So when you give us your business, we will not be experimenting (even though our name is Norton Laboratories). You will also find out that most of us are fairly easy to get along with. We are easy-going with customers and these days we are particularly nice to salesmen (as who isn't)?

Of course, like everybody else, we are rather busy producing for war. But that doesn't make us forget our manners. Nor, that it won't be long before we will be begging for your business. We're willing to start now.

Sincerely yours,

Walter J. Leyden
Molding Superintendent



MORE VITAL THAN EVER . . .

As our armies drive deeper into enemy territory the need for communications—adequate communications—becomes more vital than ever. Recently Major General H. C. Engles, chief signal officer, U. S. Army said:

> *"Communications has developed into one of the foremost military tools. I know of no other single activity which is so much a part of all military activity."*

Today Royle Continuous Resin Insulating Machines are delivering plastics insulated wire in many of the nation's wire processing plants.

JOHN ROYLE & SONS

ROYLE
PATERSON
N. J.

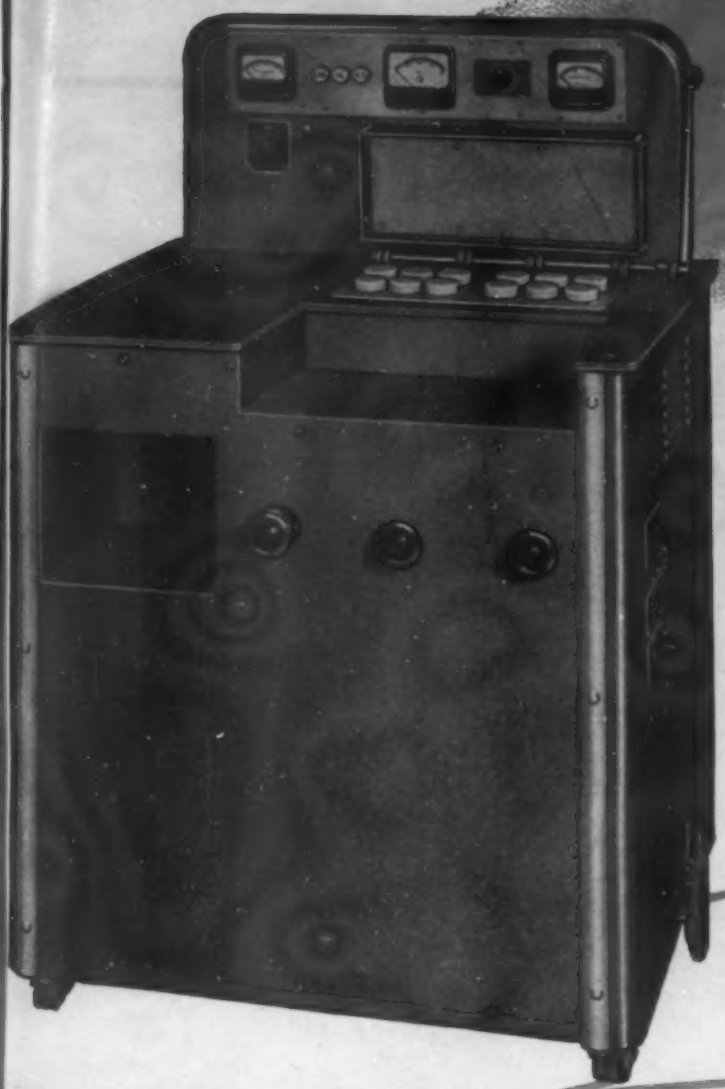
PIONEER BUILDERS OF EXTRUSION MACHINES SINCE 1880

Continental Europe
James Day (Machinery) Ltd.
London, England

Home Office
R. H. Davis J. W. VanRiper
Sherwood 3-5262

Akron, Ohio
J. C. Clinefelter
University 3726

PATERSON 3, NEW JERSEY



Announcing

illitron

TRADE MARK

HIGH FREQUENCY PREHEATING FOR PLASTICS

This new booklet describes the outstanding advantages of Illitron—gives complete specifications. Write for it today!

Illitron High Frequency Plastic Preheating Equipment is specially designed for the convenience of the plastic molder in preheating preforms, for example, rag, wood, flour, and mica filled phenolic. It is of exceptional value in preheating preforms for multi-cavity molds.

Illitron offers many outstanding features such as: built-in electrodes, automatic timer, heat-rate meter, initial matching and stepless input power control. New booklet gives complete details . . . write for it now!

ILLINOIS TOOL WORKS

2501 N. KEELER AVENUE • CHICAGO 39, ILLINOIS

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

Question: Can You Describe A Post-War Giraffe!

Answer: A post-war giraffe according to Webster, is a camelopard, an African ruminant, whose front legs are much longer than the hinder ones. But a straighter answer is—the same as a PRE-WAR giraffe.

That's also true of a lot of war parts and products that were formerly made of steel, iron, wood or some other material, but are now being made of plastic. They too will probably be the same *after* as before the war. And that's as it should be.

Plastics are not the right answer for every production problem. But they are exactly right for many, *and those are the ones we'd like to talk to you about.*

Precision Plastics Company offers an experienced and complete molding service, from creative design, if desired, through to delivery of the finished piece, a service that will be available to you the minute our war time job is over. And help with the *planning* of your post-war plastics is available right now.

PRECISION
PLASTICS COMPANY
1724 W. INDIANA AVE. PHILADELPHIA 33, PA.

WAS PRODUCED ON THIS

CAN YOU BELIEVE IT?

That a turning lathe could be capable of such work is almost unbelievable — yet this complicated plastics mould and broach actually were made on a Monarch "SHAPE-MASTER" Lathe, latest addition to the Monarch line.

All kinds of moulds, including broaches and cavities for multiple plastics moulds, punches, dies and many other classes of metal products having irregular shapes can be turned out on the Monarch "SHAPE-MASTER". In fact in turning, boring and facing it will reproduce any desired shape that a single point tool can machine and do it with — to quote the manufacturer — "uncanny accuracy", to which 24 Timken Tapered Roller Bearings make important contributions.

The Monarch Machine Tool Company has used Timken Bearings in its machines for many years and knows what they can do in promoting speed; precision; dependability; endurance; and economy; hence their liberal use in this new and revolutionary lathe. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

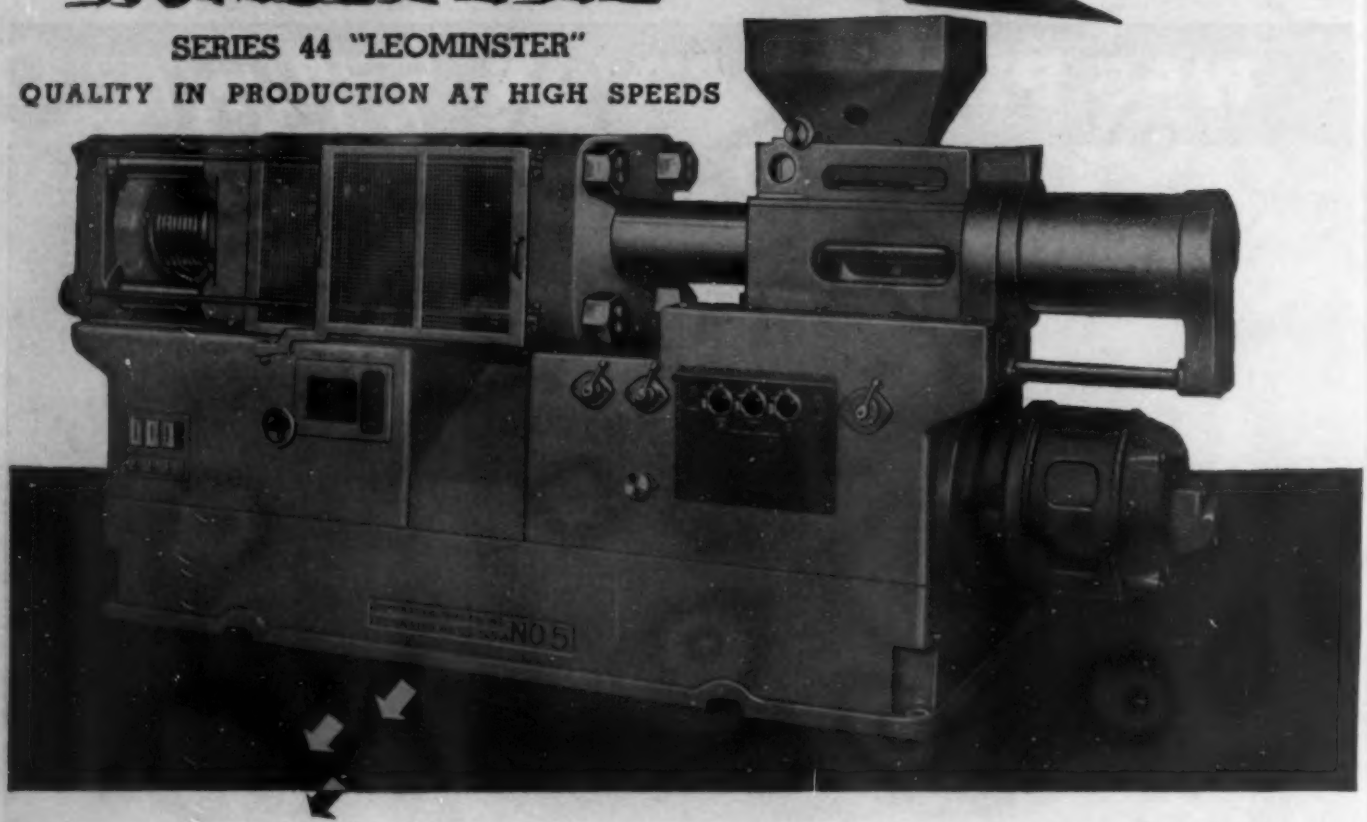
PLASTIC INJECTION MOLDING

Introducing

NUMBER FIVE

SERIES 44 "LEOMINSTER"

QUALITY IN PRODUCTION AT HIGH SPEEDS



Write Today for Series 44 Specifications And Priority Information.

Ten Years of Research and Practical Experimentation Culminates in Series 44 "Leominster" with . . .

SINGLE SCREW DIE PLATE ADJUSTMENT
and "CENTRALSHAFT" CENTRALIZED
DIE PLATE SUPPORT

For Perfect Die Alignment To Prevent "Flooding" And Rejects.

LEOMINSTER TOOL CO., Inc.

LEOMINSTER, MASSACHUSETTS

MANUFACTURERS OF MACHINES AND MOLDS FOR THE PLASTICS INDUSTRY

for Dependability!

DURITE

Reg. U. S. Pat. Off.

Plastics of Outstanding Quality to Meet Today's Production Needs

RESINS • • •

Phenol-Formaldehyde and Phenol-Furfural synthetic resins for every purpose

MOLDING COMPOUNDS • • •

Complete line of Phenol-Formaldehyde and Phenol-Furfural molding powders

CEMENTS • • •

Used universally in the manufacture of incandescent lamps, radio tubes and electronic equipment

ADHESIVES • • •

Plywood . . . for hot and cold press bonding

OIL SOLUBLE RESINS • • •

For production of air-drying or baking varnishes, protective coatings and finishes

WATER SOLUBLE RESINS • • •

For a wide variety of impregnating, coating and bonding applications

PLUS! . . . DURITE RESEARCH • • •

The DURITE laboratories are among the most modern and best equipped in the country, and have won a national reputation for research and development in plastics. You are invited to refer any of your plastic problems to our engineers.

DURITE PLASTICS

INCORPORATED

FRANKFORD STATION P.O. PHILADELPHIA 24, PA.

SYNTHETIC RUBBER COMPOUNDS PHENOL-FURFURAL PRODUCTS PHENOL FORMALDEHYDE PRODUCTS

INJECTION MOULDING
EXTRUSION MOULDING
PLASTICS
St. Louis
Plastic Parts of Every Description
ST. LOUIS PLASTIC
MOULDING COMPANY
SAINT LOUIS
MISSOURI
DIES AND TOOLS
PLASTIC FABRICATION
PIPE SARAN TUBING
MOULDED PARTS

IMPROVE MOLDING TOLERANCES WITH ELECTRONIC PREHEATING

STRONGER MOLDED PARTS RESULT FROM NEW PREHEATING METHOD

INCOMPLETE polymerization and non-uniform density rob molded parts of strength and dimensional stability.

If you preheat preforms with electronic power, uniform density and complete polymerization of the resin are easy to obtain with the result that molded parts are stronger and less likely to warp.

With electronic preheating, preforms can be heated *quickly* and *uniformly* to temperatures relatively close to the mold heat. Material preheated this way has *exceptional plasticity;* thus it flows easily throughout the mold cavity and packs in with uniform density at minimum molding pressures. And because of the uniform high-temperature preheat, uniformly complete curing is attained with a minimum of mold time.

Maximum advantage results when using molds having hard-to-heat sections and when molding larger parts, but ordinary moderately sized parts also show worthwhile gains. One piece, for example, was regularly molded with a substantially improved cure even though the shortened curing time reflected a saving of 79% over the former cycle without electronic preheating.

Thus stronger, more stable parts are easier to obtain with this advanced preheating method.

OTHER ADVANTAGES

The following are other important advantages you get from electronic preheating.

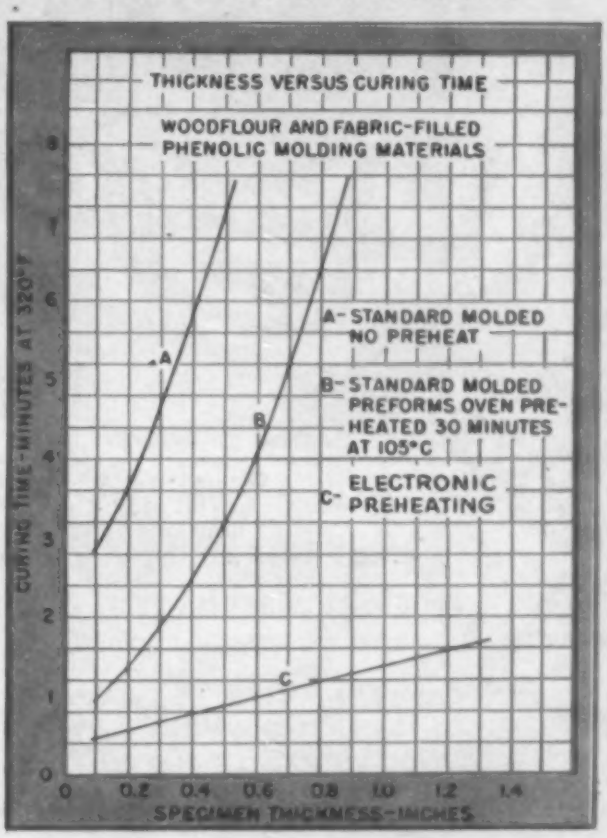
Faster Molding: High plasticity of preforms heated electronically cuts press closing time greatly (as much as 77% in one case); higher preform temperature reduces the amount of heat which the mold must supply, and greatly reduces curing time (see curve) with less uncured resin in the molded piece! Press output, on the average, can be increased 50%!

Mold Larger Pieces: The Bakelite Corporation states that "electronic preheating makes possible, for the first time, the high-speed production of very thick molded pieces." And since heating is uniform regardless of thickness, preforms weighing several pounds can be heated quickly and easily. Large parts can now be molded on standard presses.

Reduce Mold Damage: According to Bakelite, mold pressures are reduced 30% to 40%. This, together with the complete plasticity of the molding material, means freedom from mold-damage, resulting in lowered mold costs and the elimination of costly shutdowns due to damaged molds. In some cases, less expensive molds may be satisfactory as a result of the high plasticity of the molding material.

Reduced mold cost naturally means more molding jobs become practical—especially short runs.

Write for Details: RCA engineers will be glad to consider your preheating problem. Send the coupon below, or write, stating your problems or questions, to RCA, Electronic Apparatus Sec. (70-36), Camden, N. J.



●How curing time is speeded for molded pieces of various thicknesses with electronic preheating: (A) non-preheated; (B) oven-preheated; (C) electronically preheated. *Courtesy of the Bakelite Corporation.*

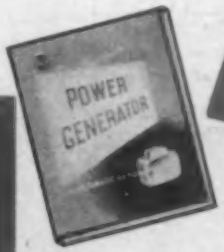
Listen to "THE MUSIC AMERICA LOVES BEST" on the RCA program every Saturday, 7:30 P. M., E.W.T., Blue Network

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION, CAMDEN, N. J.

LEADS THE WAY . . . in Radio . . . Television . . . Tubes . . . Phonographs . . . Records . . . Electronics



FREE

BUY MORE WAR BONDS

(Please Check)

☐ "Engineering Data Form P"—a quick way to tell us your needs

☐ Bulletin on "RCA Electronic Generator Model 2B"

☐ "Electronic Heat Speeds Plastic Molding"—a semi-technical article

RCA, Electronic Apparatus Sec., Camden, N. J.
Gentlemen: Please send the items checked to:

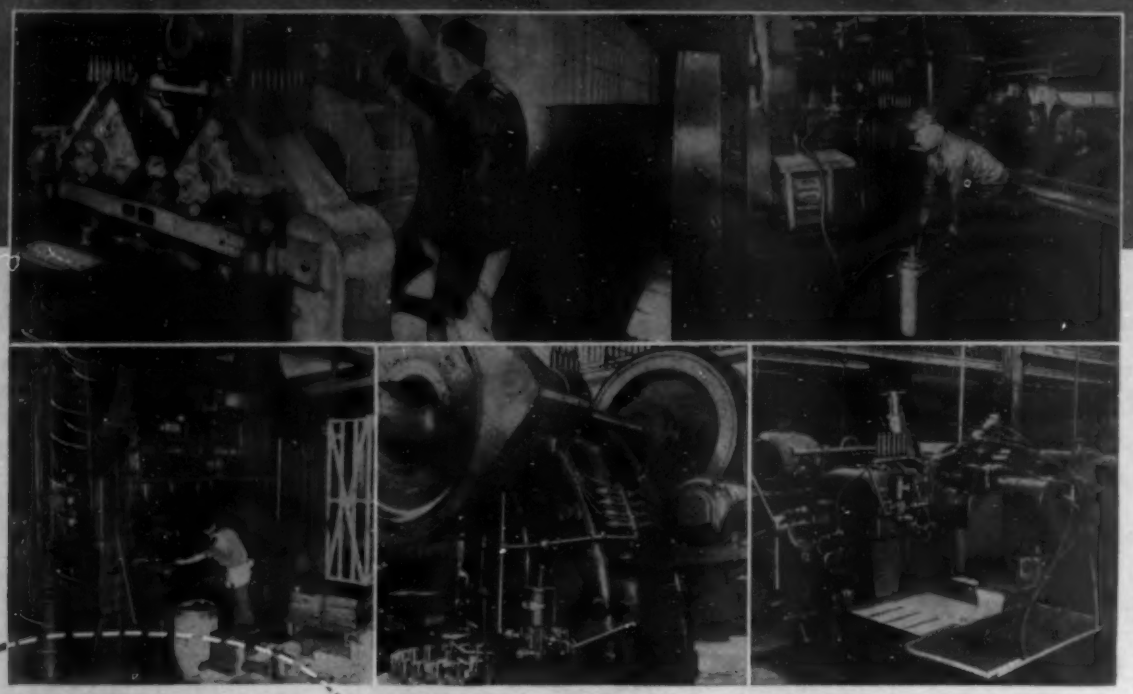
Name.....

Company.....

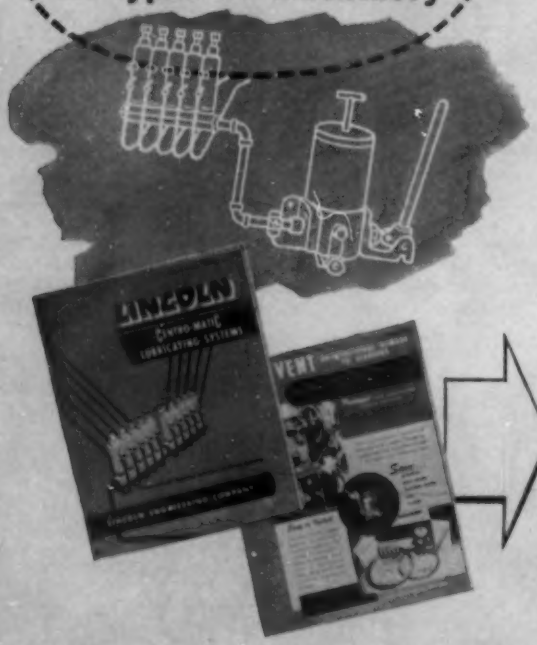
Address.....

City.....State.....

LINCOLN CENTRO-MATIC LUBRICATING SYSTEMS...



THE *Modern* WAY TO LUBRICATE all types of machinery



The Lincoln *modern method* of centralized lubrication, makes it possible for all bearings on one machine, or on a series of machines, to be lubricated from a central source without stopping the machines.

The Lincoln Centro-Matic System consists of a number of Centro-Matic Injectors—one for each bearing—and a hand-operated, or a power-operated Centro-Matic Lubricant Pump. The system is easy to install and will help increase your plant efficiency, not only today, but for years to come.

I WOULD LIKE TO HAVE FREE BULLETIN
On Lincoln Centro-Matic Lubricating Systems.

Name _____

Title _____

Company _____

Address _____

City _____ *State* _____

MP 144-7D

ARMY E NAVY

LINCOLN ENGINEERING COMPANY

Pioneer Builders of Engineered Lubricating Equipment

5701 NATURAL BRIDGE AVE., ST. LOUIS 20, MO., U. S. A.

CONTINENTAL CAN COMPANY

announces

a new laminated plastic—

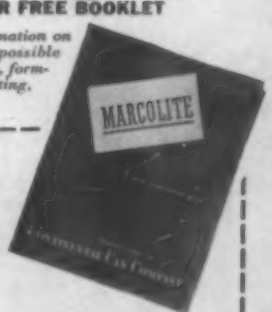
MARCOLITE

HERE'S a new low-pressure, high-strength plastic laminate with almost *unlimited* possibilities. Marcolite can be formed in large assemblies, in virtually *any* size and shape, and color. It's almost completely resistant to solvents; stable at −70°F or +300°F; highly resistant to abrasion; and in addition has high dielectric strength as well.

At present, Marcolite is being manufactured solely for high priority, military use. However, we urge you to find out *now* how this revolutionary new plastic can be tailored to suit your future needs. For complete details, clip the coupon for descriptive booklet.

SEND FOR FREE BOOKLET

Gives information on properties, possible applications, forming, fabricating, etc.



CONTINENTAL CAN COMPANY, INC.

CONTINENTAL PLASTICS DIVISION

MOLDED PLASTICS:
Reynolds Molded Plastics • Cambridge, Ohio

LAMINATED PLASTICS:
Continental Can Company, Inc. • Chicago
New York • Los Angeles

LAMINATION • COMPRESSION • INJECTION • EXTRUSION • SHEET FORMING

Continental Can Company
Plastics Division, Dept. MP1.
100 E. 42nd Street
New York 17, N. Y.

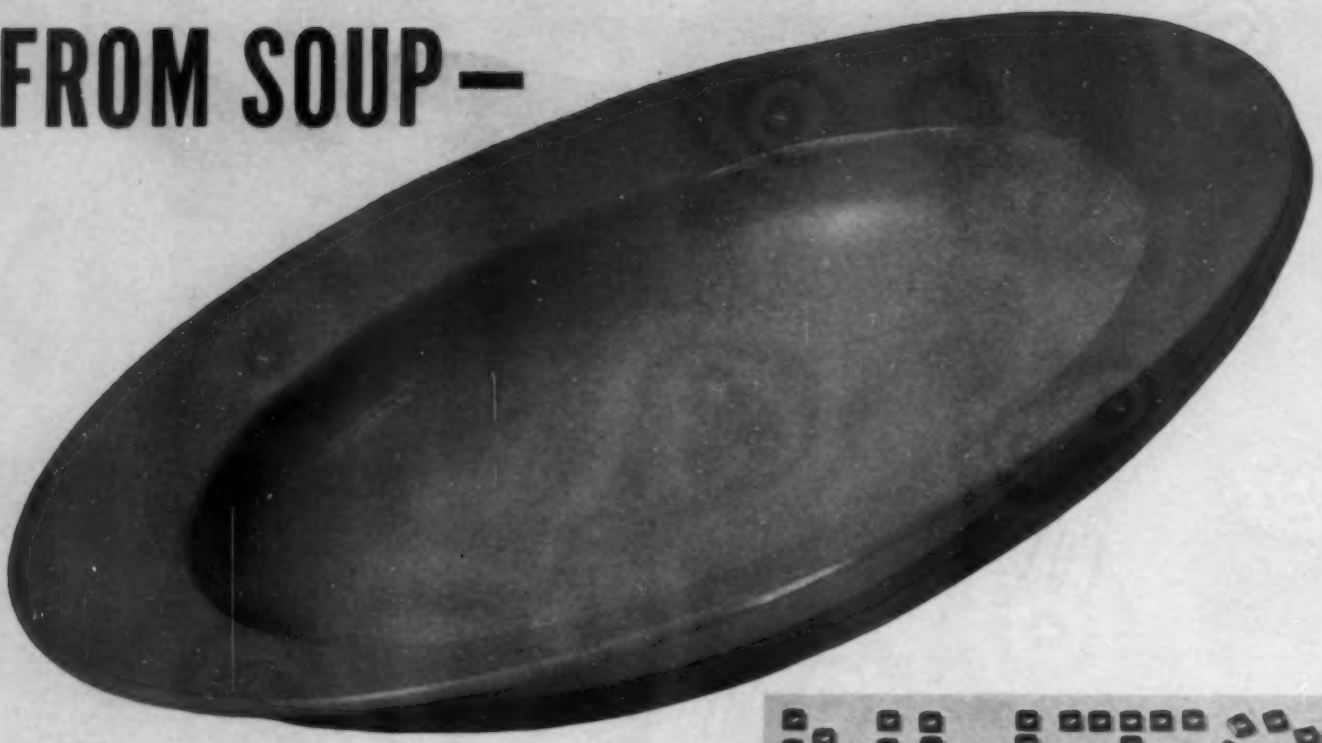
Please send me your free booklet that tells about Marcolite.

Name_____

Firm Name_____

Address_____

FROM SOUP—



—TO NUTS

It is vitally important, in choosing a custom molder, to employ one who offers a complete, well-rounded service. At Watertown, we offer a combination of services from resin making and formulation of Neillite materials to final buffing, polishing and fabrication. Compression, injection and transfer molding are employed in the shaping of our own Neillite materials, ureas, melamines and all the other standard thermosetting and thermoplastic materials of other manufacturers.

Our techniques, based on 29 years of experience, utilize the most advanced methods of molding and testing plastics. Our many presses are capable of forming small and large shapes of intricate design with inserts embodied. Our engineers offer comprehensive assistance—from designing shapes and choosing materials to final assembly of the molded sections—and give personal attention to each detail every step of the way.

Whatever your problem in plastics, consult The Watertown Manufacturing Company, 1000 Echo Lake Road, Watertown, Conn. Branch office — Cleveland. Sales offices — New York • Chicago • Detroit • Milwaukee.

Watertown

A NAME AS OLD AS THE PLASTICS INDUSTRY

HOW TINY GRAINS OUTWIT THE TOUGHEST ALLOYS

Varcum Bonding Resins give custom-made stamina to Industry's grinding wheels

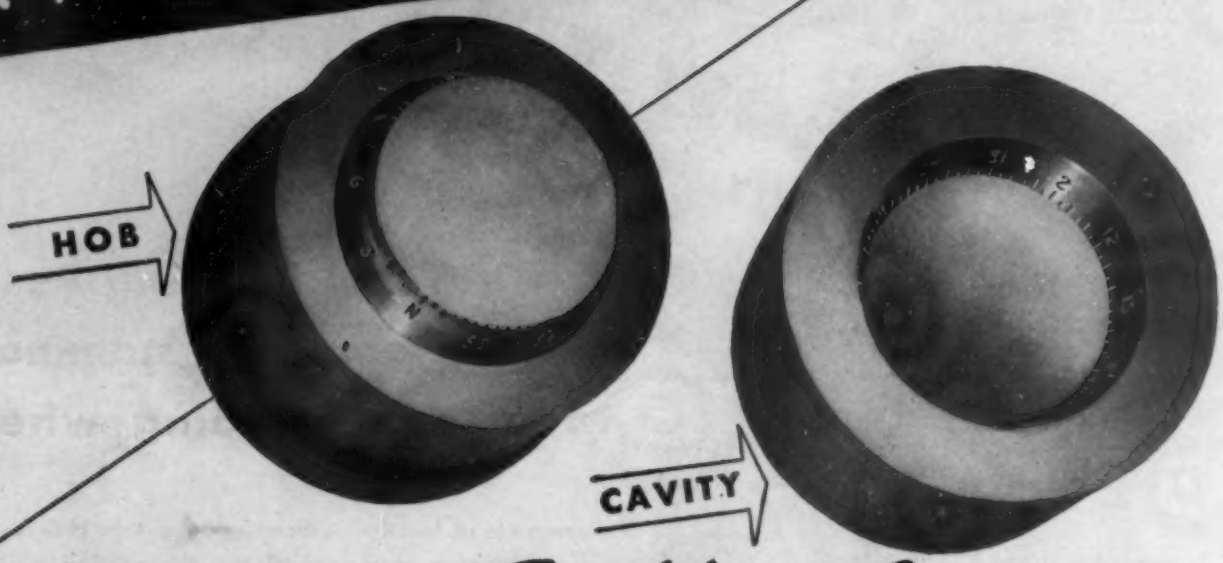
It may seem a far cry from those innocent looking particles of abrasive grain—to a high-speed grinding wheel which cuts away the hardest alloys.

But it's not such a big step. Not with custom-made Varcum Resins bonding the grain into a permanently cohesive mass. Varcum Bonding Resins are formulated to meet each specific wheel requirement, whether it be a fine-grain precision wheel or a coarse snagging wheel. Varcum research technicians are equipped through specialized experience to work with you on your present and future bonding problems. Your inquiry will receive prompt attention.

VARCUM
CHEMICAL CORPORATION
NIAGARA FALLS, NEW YORK

ONE OR . . . (How many?)

Hobbed Cavities by Midland . . .



EACH AND EVERY *Hobbed Cavity* MUST BE RIGHT!

Beautifully simple, this idea of hobbed cavities for plastic molds. Merely prepare a hob, precisely like the part to be molded, and press it into the required number of blanks—and you have your cavities! If only that were all there were to it!

Midland's experience, accumulated through years of specialized service to the plastics and die casting industries, has uncovered the answer to many a problem, such as what steel, what pressure, how to harden—so that the care, skill and time of the die maker and engraver, expended on the hob, will not come to grief in some unforseen development in the steps that follow. Users of molds who rely on Midland for hobbed cavities appreciate the advantage of having this experienced, centrally located source of precision molds and dies.

Send for a copy of our recent publication, "Shaping Tomorrow Today" explaining some of the reasons you will profit by sending your tough mold jobs to Midland. Write for it today!

D&E

MIDLAND DIE AND ENGRAVING COMPANY

1800 W. BERENICE AVENUE . . . CHICAGO 13, ILLINOIS

Makers of Plastic Molds • Die Cast Molds • Engraved Dies • Steel Stamps • Hobbings • Pantograph Engraving

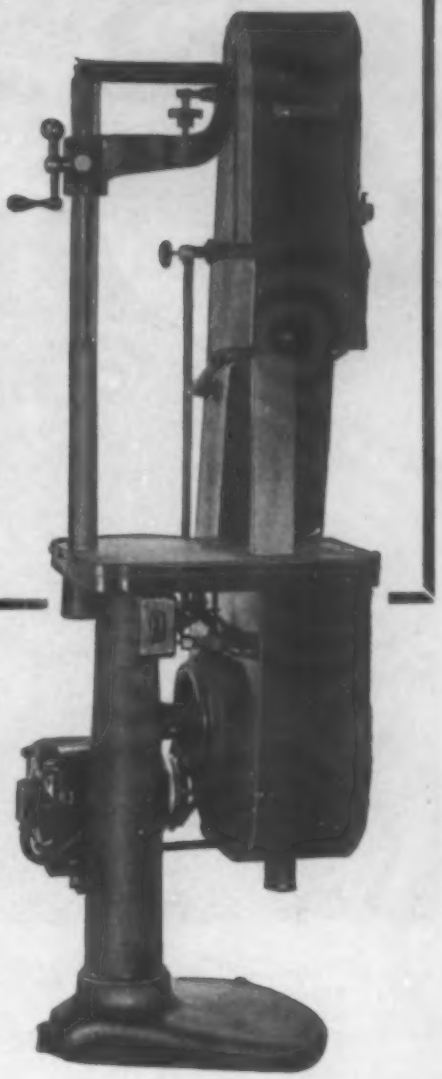
Practical for Thermoplastics; Preferred for Thermo-setting Plastics

- Finishes both curved and flat surfaces
- Reduces flow, discoloration, burning, dust and loading of belt
- Leaves no coarse tool marks to cause cracks or checks in urea plastics

PORTER-CABLE

Wet-Belt SURFACER

overcomes the low heat conductivity of plastics; banishes the rapid heating of finishing tools

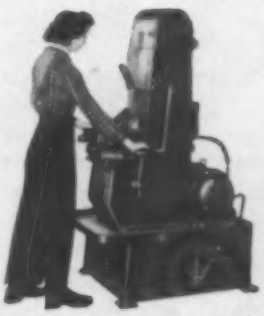


No matter how thick the flash line, or how deep the surface scratches; no matter whether you are finishing flats or radii to approximations or precision limits, no matter if you are "hogging off" cold-molded pieces to true dimensions this Porter-Cable WET-BELT Surfaces will handle the job—faster, more economically and to more rigid specifications.

More—there'll be no noticeable flow, discoloration, burning or dust. No heating or loading up of the belt. No softening of acetate butyrates, ethyl celluloses, styrenes, acrylics or vinyl resins.

The B-6W model features a flexible belt, which in combination with a shaped and flexible-face platen, enables close finishing of complex and difficult contours with a single pass. A combination that is especially efficient on high-volume, multiple-part production. Arbor fixtures enabling the part to turn with the belt, assure true roundness on cylindrical parts.

Model G-4 is especially useful in handling small parts, refinishing rejects or oversize parts, or taking off sprues and gates. Machine may be used with belt in horizontal position.



Model AG-8 is a high-production machine for close-limit work. Easy to use, it enables green and semi-skilled operators to finish true flats to close limits of flatness and parallelism. Single pieces can be finished free-hand, or mounted in gang jigs for simultaneous finishing of several parts in one pass.

WRITE TODAY

for a free copy of our latest handbook, "A New Precision Machining Method." It describes new and highly efficient ways of speeding flow of your product from the presses to the packing boxes.

PORTER-CABLE MACHINE CO.
1606-7 N. Salina St.,
Syracuse 8, N. Y.

Please send me a copy of "A New Precision Machining Method."

Name..... Title.....

Company.....

Address.....

Accurate Weighing—the Secret of Good Plastics...

EXACT WEIGHT Scale in a plastics molding operation on the west coast in the plant of McDonald Manufacturing Co., Los Angeles, California.

do it the Exact Weight Way...

Good Plastics start with skillful, careful ingredient compounding. The finished product is materially affected by this first operation. This operation requires skill and the right tools in the form of weighing equipment. Plastic ingredient compounding requires accuracy—utmost accuracy. In order to get on with the work it requires speed as well. That is why EXACT WEIGHT Scales are so popular with the industry as a whole. They deliver both everytime. Other uses include color blending and check-weighing of finished molds.

INDUSTRIAL PRECISION

Exact Weight Scales

THE EXACT WEIGHT SCALE COMPANY

650 W. FIFTH AVE., COLUMBUS 8, OHIO
Dept. AC, 1104 Bay St., Toronto, Canada

"HELLO BOSS— TELL THAT NEW GUY TO KEEP USING THE CAMBRIDGE"

Guessing mold temperatures may cause loss of both labor and material from soft centers, off colors and warping. With new help, new powders and new requirements for plastics, it is more important than ever before to use the *Cambridge* Mold Pyrometer. It is so simple to use even inexperienced help can use it effectively in determining temperatures of mold cavities.

BUY WAR BONDS

Combination and Single Purpose Instruments

Cambridge Instrument Co., Inc.
3732 Grand Central Terminal, New York, N.Y.

CAMBRIDGE
Mold • Roll • Needle
PYROMETERS

Bulletin 194—5 gives details of these instruments. They help save money and make better plastics.

VICTORY WILL BE OURS

BY PULLING TOGETHER!

We are here to serve our Country, and Customers Old and New, by Providing High Quality Molded Parts.

Our trademark stands for justice, and is backed by an engineering staff of more than thirty years experience.

This background is yours for the asking. Consult us with your problems, small or large, simple or complicated.

Compression and Transfer Molding of Thermosetting Materials Is Our Specialty

PLASTIMOLD, INC.
ATTLEBORO, MASS.

Susie Smith becomes an artist!

Meyercord Decorative Decals enable production-line workers to decorate thousands of units — beautifully and uniformly — in the time formerly required by an artist to handpaint one. Meyercord Decal Decorations produce hand-painted effects . . . give your products that extra eye-appeal which assures extra buy-appeal . . . with mass-production economy. Obtainable in any design, size and colors. They're washable, durable, inexpensive and can be applied on any wood, metal, plastic or glass. Decorate *your* post-war products this modern Meyercord Decal way. Address all inquiries to Department 21-7.

Buy War Bonds . . . and Keep Them!

MEYERCORD

THE MEYERCORD CO., CHICAGO 44, ILL.

SALES OFFICES IN PRINCIPAL CITIES

Decals

WANTED: PLASTICS SCRAP

OUR BACKGROUND:

- Forty years experience
- National in scope
- Efficient and prompt service

H. MUEHLSTEIN & Co. INC.

122 EAST 42nd STREET, NEW YORK 17, N. Y.

LOS ANGELES: 1431 E. 16 St. • MEMPHIS: 46 W. Virginia Ave. • CHICAGO: 327 So. La Salle St. • AKRON: 250 Jewett St. • BOSTON: 31 St. James Ave.

WESTFIELD 2-4300

THE pyro PLASTICS COMPANY

WESTFIELD, NEW JERSEY

New STOKES 50-Ton Hydraulic

Completely Automatic Press

- **LARGER PIECES**
- **MORE PIECES**
- **HIGH SPEED OPERATION**

100% Automatic

Model 23S

Patented

OUTSTANDING FEATURES

Automatic Cycle Controller, the "brain" of the machine, for split-second timing of every machine operation — proved in hundreds of Stokes Completely Automatic Presses in the country's leading molding plants. Cycles have been reduced as much as 50% or more. Human errors are eliminated. Every piece is identically molded.

Super-Sensitive Trap or checking device — sensitive to the fraction of a gram. The "heart" of the machine that checks every molded piece made. Failure to eject — lack of material — or any other irregularity stops press instantly. The pieces literally "run the press." The only proved and foolproof method of operating a Completely Automatic Machine.

Multiple Feed with micrometer adjustment. Capacity up to 48 cu. in.

High Speed Operation. Opening and closing at the rate of 100 in. per min. with controlled final compression speed adjustable to the flow characteristics of the molding material.

One Man Operates a Score of Presses. Completely Automatic, this press requires only a minimum of molding labor. Once set up, one man can attend a large battery of presses as only attention required is to keep hoppers filled and to remove accumulation of molded pieces.

Low Power Requirement. Only 2 hp. motor required to develop full 50 tons press capacity.

Self-Contained, Self-Sufficient. Electrically powered and heated. Requires only electrical and compressed air connections.

Write for Complete Information

F. J. STOKES MACHINE CO.
5934 Tabor Road Philadelphia 20, Pa.

F.J.Stokes MOLDING EQUIPMENT

FJS Est. 1895

ACCOMPLISHMENT

is what counts

CLAIMS of unusual ability in the injection molding of thermoplastics are meaningless . . . unless backed by evidence of ACTUAL ACCOMPLISHMENT. In this respect, Standard Molding Corporation has one of the industry's really unique records.

Above are shown but 41 of the hundreds of plastic parts that Standard has successfully produced by the injection molding process. Many of these are delicate instrument parts for fighter aircraft . . . parts which must be turned out on a mass production basis, and yet conform to the micrometric tolerance demands of the Air Forces.

The manufacturing and engineering skills that made these plastic achievements possible are now available to you in the development of your present and postwar products. For expert and detailed analysis by the Standard Engineering Staff, mail us your blue-prints today.

STANDARD MOLDING CORPORATION

Dayton 1, Ohio

WRITE FOR THIS CATALOG
—on your business letterhead, or tear out this coupon and attach it to your stationery today.

Standard Molding Corporation
Dayton 1, Ohio
Please send me a copy of your new Plastics Catalog without charge or obligation.

Name_____

Firm Name_____

Address_____

City_____ Zone____ State_____

SPECIALISTS

INJECTION MOULDING

THE GROTELITE CO.

INCORPORATED

GRANDVIEW & LAFAYETTE AVE.

BELLEVUE, KENTUCKY

New Dillon-Beck booklet containing unusual case histories showing how a complete molding service efficiently produced many items valuable to the war effort.

You'll find these industrial news-stories interesting and informative. Write today for your free copy!

DILLON-BECK MANUFACTURING COMPANY

103 MONTGOMERY AVE., IRVINGTON, N. J.

ENGINEERS · DESIGNERS · MOLDERS

tough
GEMEX RIVET SETS
are made of
GRAPH-MO STEEL

Steel must be able to take a high smooth finish to prevent scoring of rivet heads and withstand a terrific beating to meet the high standards of the Gemex Co., makers of custom made rivet sets. That's why they use Timken Graph-Mo Steel.

A smooth mirror-like finish can be produced on tools made of this fine performance-proven steel. In addition Graph-Mo has a high responsiveness to heat treatment, enabling skilled Gemex workers to make tough, strong tools of extreme accuracy that have a remarkably long service life.

Whenever you have a tool or die problem use one of the five famous Graphitic Steels, Graph-Mo, Graph-Tung, Graph-Sil, Graph-Al or Graph-M.N.S. They have excellent wearing properties, they machine at least 25% faster than competing steels and have less tendency to score work. Important factors today that will be equally important when preparing for keen Post War competition. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

5TH WAR LOAN

A request on your firm's letterhead will bring a fully illustrated booklet that contains complete information about the five performance-proven Graphitic Steels.

COTTON DUCKS

for

Laminators and Molders

Our Southern mills have made high-tensile cotton fabrics for the Plastics industry for fifteen years and specialty industrial cotton textiles for over thirty-five years. Our experienced development and production facilities are available to the Plastics trade, limited only by the requirements of our armed forces.

Curran & Barry

320 BROADWAY NEW YORK CITY

KNOW NOSCO

MOLDERS **of Thermo-Plastics:** Custom molders with diversified production experience

TOOL & DIE **Department:** Technical knowledge that saves you money

ENGINEERING **Department:** Working with you before and after production starts

PLANNING & SALES **Dept.:** Proper planning with creative ability

Free!

Each month we offer a brand-new, plastic "whatnot." We will gladly send one of each to you, without cost or obligation. Write to the address given below.

NOSCO Plastics

DIVISION OF
NATIONAL ORGAN SUPPLY CO • ERIE, PA.

R

"Dig a well before you are thirsty."
—*Chinese Proverb*

RECTO

MOLDED PRODUCTS, INC.

CINCINNATI, OHIO
Melrose 6862

•

DETROIT
L. S. HOUSE
3-167 General Motors Bldg., Madison 5781

•

INJECTION AND COMPRESSION MOLDING

This

ATLAS Type "E"

High Pressure Reducing Valve

is now being used with utmost satisfaction in numerous plastics plants throughout the nation. Orders for additional valves are being received nearly every day—and there is no better proof of satisfaction than repeat orders.

This extraordinary valve handles air, water, or oil at pressures up to and including 6,000 lb. per sq. in. *without shock.*

Try one. The chances are that you, too, will be ordering more for those pressure reducing jobs that you now consider difficult.

How is it made?

Its construction is not a secret. Our specialty for nearly a half century has been and still is: "Regulating Valves for Every Service." Hence its excellence. Its design is based on the latest and best principles. Every detail is up-to-date. Forged Steel Body. Internal metal parts entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

For other ATLAS plastics plant products see the partial list in our ad in the January 1944 issue of MODERN PLASTICS.

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

277 South Street, Newark, N. J.

Representatives in principal Cities

A New Way to kill Japs!

Just tap them on the head with our new screw driver handle! This handle is solid and tough—well grooved to give added turning strength to the fingers and hand.

Handles for refrigerator drawers, paper cutters and other purposes are a specialty with us.

Write us about your post-war handle needs.

INJECTION MOLDED PLASTICS
MINCOR
YOUR PLASTICS DEPARTMENT

TENITE I • TENITE II • VINYLITE • LUCITE
POLYSTYRENE • LUMARITH • PLEXIGLASS

★

MINNESOTA PLASTICS CORPORATION

SAINT PAUL 1, MINNESOTA

STANDARD BASES FOR INJECTION MOLDS

DETROIT MOLD ENGINEERING

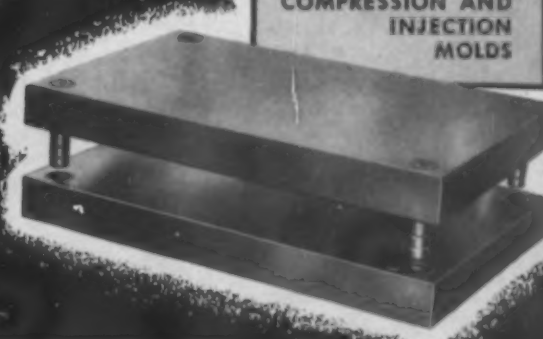
DEPENDABLE MOLDING EQUIPMENT

DESIGNED FOR MAXIMUM EFFICIENCY

DIMINISHES MOLD MAKING ERRORS

DELIVERS MORE ECONOMY

CAVITY RETAINER PLATES FOR COMPRESSION AND INJECTION MOLDS



STANDARD EQUIPMENT FOR PLASTIC MOLDS

Send your name . . . and a copy of DME NEWS will be mailed to you monthly.

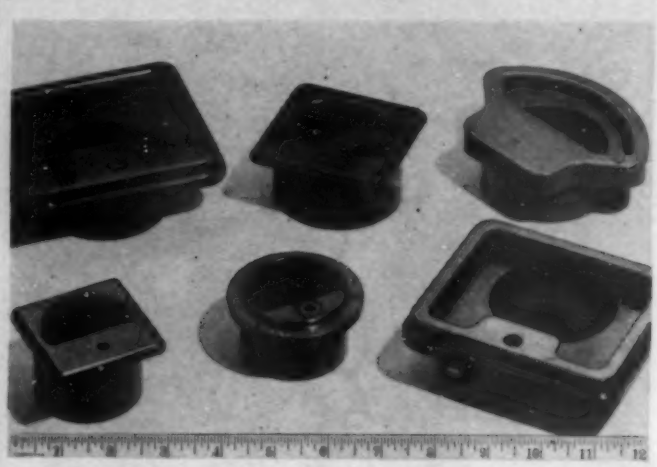
DME
DETROIT MOLD ENGINEERING COMPANY
4837 WOODWARD AVENUE • DETROIT 1, MICHIGAN
NEW YORK Office—475 Fifth Ave.—Telephone Murray Hill 3-5108

FINE electric furnace steels. Disston Plastiron and Plastalloy are made to fine tool standards and are *ideal* materials for plastic molds. They have a low carbon content — excellent for difficult shapes — are thoroughly clean and uniformly sound — produce unusually smooth cavities — carburize evenly — and will withstand extreme hobbing.

Engineering Cooperation... Disston metallurgists and engineers will gladly cooperate in adapting Plastiron to your present methods — and will help you with postwar planning. Write fully to Henry Disston & Sons, Inc., 734 Tacony, Philadelphia 35, Pa., U. S. A.

SKILLED AND TOOLED FOR PRECISION MOLDING

Instrument Cases...



Custom Molded Plastics engineered by Midwest, consistently measure up to exacting specifications and requirements. Address your inquiries to MMM, confident that you are consulting an organization skilled and experienced in precision techniques for the production of plastics.

Midwest Molding
AND MANUFACTURING COMPANY
331 NORTH WHIPPLE STREET • CHICAGO 12

GLYCERINE

QUICKLY AVAILABLE AT A STOCK POINT NEAR YOU!

Armour's 332 stock points mean fast, dependable service for your present and future glycerine needs.

CHEMICALLY PURE or U. S. P. . . . A high grade, water-white glycerine meeting the requirements of the United States Pharmacopoeia. Suitable for use in foods, pharmaceuticals, cosmetics or for any purpose where the highest quality is demanded. It has a specific gravity of 1.249 – 25°C./25°C.

HIGH GRAVITY . . . A pale yellow glycerine for industrial purposes with a specific gravity of 1.262 – 15.5°C./15.5°C.

DYNAMITE . . . A yellow glycerine made especially for the explosives trade. It has a specific gravity of 1.262 – 15.5°C./15.5°C.

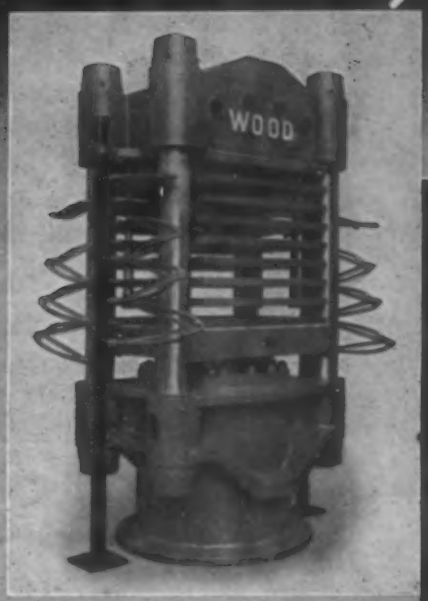
YELLOW DISTILLED . . . A yellow glycerine for industrial purposes with a specific gravity of 1.259 – 15.5°C./15.5°C.

ARMOUR AND COMPANY
1355 WEST 31ST STREET • CHICAGO 9, ILLINOIS

For the Plastics Industry . . .

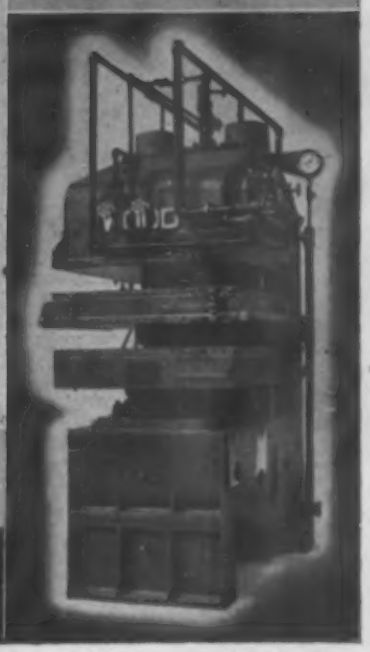
. . . HYDRAULIC PRESSES BY R. D. WOOD

R. D. Wood Hydraulic Presses for the plastic industry are built in a comprehensive standard line of many types and sizes. In addition, special presses are constantly being developed for special requirements. High production, ease of operation, low maintenance and long life are characteristics of every Wood press—standard or special. Consult with Wood on hydraulic press problems.



An 8-opening 700 ton steam Platen Press with 40" x 40" Platens.

285 ton, precision type, open-side Belt Press, with 36" x 48" Platens.



HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE

EST. 1803 R. D. WOOD CO. 400 CHESTNUT STREET PHILADELPHIA 5, PA.

MODELS in PLASTICS

Pre-test your idea, demonstrate your new product to prospects and get orders in advance of production with plastic models.

Precisely built transparent study models show the inside workings of your product.

Try us on your next item. We also build injection, compression and transfer molds.

STRICKER - BRUNHUBER CO.
Mechanical Developers
19 W. 24th Street S-B New York 10, N. Y.
WAtkins 9-0191-2

EXTRUDED THERMO PLASTICS

for

WAR WORK

and

Essential Civilian Applications

★

Shapes — Profiles
Strips — Tubes

Made to Order ONLY
No Stock Items
Details, Quotations — *Promptly*

AMERICAN PLASTICS CORP.
225 West 34th St. New York City 1

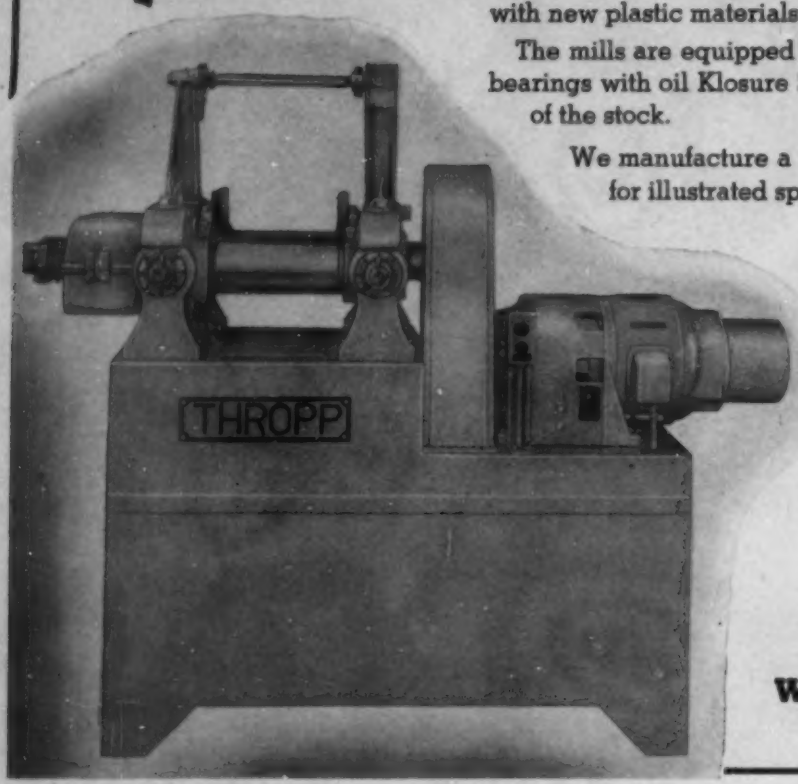
New!

MODERN LABORATORY MILLS DESIGNED FOR MODERN PLASTICS

These New Thropp Laboratory Mills are specially designed for use with new plastic materials requiring temperature milling.

The mills are equipped with flood lubricated fully bronze lined roll bearings with oil Klosure Seals on each end to prevent contamination of the stock.

We manufacture a complete line of mills and calenders. Send for illustrated specification sheets and prices.



New! ELECTRONIC Variable Speed Drive

New Thropp Laboratory Mills and Calendars can now be equipped with G. E. THY-MO-TROL Drive, providing wide speed range and close speed regulation from A. C. source of supply.

WM. R. THROPP & SONS CO.
Trenton, New Jersey

IDEAL SCRAP GRINDER FOR CRAMPED QUARTERS

The Standard Ideal model Ball & Jewell scrap grinder occupies a minimum of space. Special design gives maximum production in small area.

Has 2-belt Texrope drive, 2 H.P. ball bearing motor, outboard sealed SKF bearings, 7 solid tool-steel knives, sturdy cast construction, 3 interchangeable screens, removable bin and baffled hopper.

Send for prices, FREE catalog of 13 models.

•BALL & JEWELL•
20 Franklin Street Brooklyn, N. Y.
Since 1895, Manufacturers of Patent Rotary Cutters
or get in touch with nearest representative.
CHICAGO: Neff, Kohlbusch & Bissell. DETROIT: J. C. Austerberry's Sons. LOS ANGELES: Moore Machinery Co. LOS ANGELES & SAN FRAN-CISCO: Machinery Sales Co. MINNEAPOLIS, MINN.: Boyd & Walker, 506 Northwestern Bank Bldg. NEW ENGLAND: Standard Tool Co., Leominster, Mass. NEW YORK: Alsing Engineering Co., 111 8th Ave. ST. LOUIS: Larrimore Sales Co. WICHITA, KAN.: Fluid Air Engineering Co.
LONDON, ENGLAND: Blackfriar's Engineering Co., Ltd.
SYDNEY, AUSTRALIA: Scott & Holladey, Pty. Ltd.
CANADIAN AGENT: Williams & Wilson Ltd., Toronto & Montreal, Canada

Rabbeting Plexiglass Panels for Smooth fit in Metal Frames ..a job for the CARTER S5A Table Shaper

For perfect streamlining, transparent plastic panels must set in metal frames with a smooth flush fit. The necessary rabbet around the edge is cut fast, clean, and to accurate dimensions on the Carter S5A Table Shaper. Most shapes and contours can be handled with simple jigs.

The 1 H.P. motor unit on the Carter S5A can be tilted 45° backward, 25° forward to permit all types of cuts. Write for details. R. L. Carter Div., The Stanley Works, 175 Elm Street, New Britain, Connecticut.

CARTER TIME-SAVING TOOLS

EEMCO

HYDRAULIC PRESSES

EEMCO Plastics Molding Presses can be equipped with pull-back or push-back cylinders and knockouts for ejecting molded pieces.

Write for quotations—giving size of platen and opening required for the press or presses needed.

★ ★ ★

Send for bulletins describing any of the following EEMCO Machinery:

MILLS
REFINERS
WASHERS
EXTRUDERS
STRAINERS
PRESSES
CALENDERS
TUBERS
CRACKERS

★ ★ ★

EEMCO

ERIE ENGINE & MFG. CO.

953 EAST 12th ST., ERIE, PENNA.

3-M METHOD OF FINISHING PLASTICS

NO BURNING...
NO SCORCHING...
NO PLASTIC FLOW...
Just a Fast, Economical Finish

THE high speed application of a perfect finish is the 3-M Method's contribution to the plastic industry. Flashings and other molding imperfections are removed without a trace of scorching or plastic flow—dustlessly, too.

The 3-M Method leaves your product perfectly finished and properly prepared for a high luster packed with sales appeal. If you have a plastic finishing problem, let our years of abrasive experience suggest a solution.

MFRS. 3-M PRODUCTS

MINNESOTA MINING AND MANUFACTURING CO.
GENERAL OFFICES: SAINT PAUL 6, MINN.
BRANCHES IN PRINCIPAL CITIES

MPL744

Gentlemen: We are interested in finishing Plastics ☐ Glass ☐ Metal ☐

Name_____

Address_____

City_____ Zone____ State_____

BUY MORE WAR BONDS!

PRECISION UNIFORMITY

RESINS and PLASTICIZERS

Resins —
Piccolyte Terpene Resins
Para Coumarone Indene Resins

Plasticizers —
A complete line to meet the requirements of all types of plastics compounding. We will gladly provide laboratory assistance in helping determine plasticizers best suited to your specific problems.

Precision in production and testing assures the maintenance of exacting specifications on all our compounding materials . . . This fact can be of vital aid to you in protecting the results of your plastics production . . . Write for complete data on these materials.

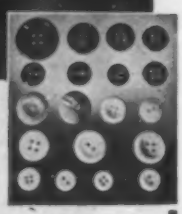
STANDARD Chemical Company
General Offices: AKRON 8, OHIO

Standard Tool Co.
LEOMINSTER, MASS.
are privileged to fly the
ARMY-NAVY "E" Flag

for excellence in the production of
GAGES
and
INJECTION and TRANSFER
types of molds for
ALL KINDS OF PLASTICS

Automatic Button Finisher

ELIMINATES MANPOWER PROBLEMS



THIS compact automatic machine punches fins and cleans holes of Urea, Phenol and Melamine buttons. Completely automatic it saves countless man-hours of work and performs with perfect efficiency. Can be set & re-set to handle all sizes. 3 models: Model S accepts sizes 12 to 34; Model SP accepts sizes 36 to 50; Model SX accepts sizes 12 to 50. Production up to 450 per minute.

ButtOndeX
CORPORATION
386 FOURTH AVENUE NEW YORK, N. Y.

FIGHTING for our FIGHTING FORCES

All Set for PEACETIME VOLUME

At this time our only thought is to get our boys back home and every effort we put forth is in this direction.

After this has been accomplished and once again we can turn all our efforts to a post-war era, we want to demonstrate our ability to fashion the better things to come in molded plastics.

Fundamental knowledge, advanced thinking and new techniques combined with experience and the ability to produce will again attract users to our plant — one of the * time-proven plants in the plastic industry.

* Average employee over 20 years plastic experience.

MICHIGAN MOLDED PLASTICS, Inc.

Dexter M Michigan

CUSTOM MOLDING

COMPRESSION • INJECTION • EXTRUSION

WANTED:

New PRODUCTS

Have you a new product, device or process that will accomplish a result faster, cheaper or better than those now in use? If so consult us at once. We have been retained by a number of companies in a wide variety of industries to find new products and processes for postwar. If your idea is acceptable to them an attractive contract for purchase or licensing will be arranged. (Our service is free to you.) Send a copy of patent, or drawings and description and tell us whether a model is available. All information treated in strictest confidence. Write to—

NEW PRODUCTS DIVISION

DFI DESIGNERS FOR INDUSTRY, INC.

2915 DETROIT AVENUE • Dept. P-6 • CLEVELAND 13, OHIO

Hanna

Air and Hydraulic

Cylinders

• On 1001 jobs Hanna Cylinders simplify and improve operations—save time and labor—help increase production.

Where can you make use of Hanna Cylinder Power as suggested in these illustrations?

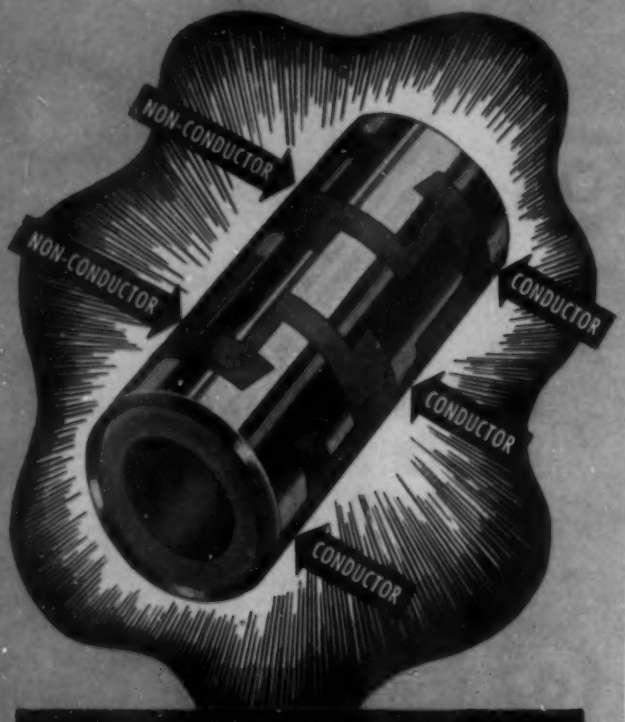
Write for Hanna Cylinder Catalogs No. 230 (low pressure cylinders) and No. 233 (high pressure cylinders).

HANNA ENGINEERING WORKS

1765 ELSTON AVENUE • CHICAGO 22, ILLINOIS

AIR & HYDRAULIC CYLINDERS • RIVETERS • AIR HOISTS

INTRICATE *Commutators* NOW EASILY MADE!

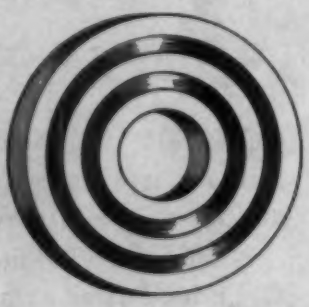


METAPLATED *in one piece!*

PRACTICALLY any intricate commutating surface, either flat or round, can be obtained by Metaplating in the grooves of an insulator. The plating is brought up flush with the surface regardless of the depth of groove.

Commutators having conductive surfaces as narrow as .005 inch are readily Metaplated.

Our engineering department will gladly assist you.



The Slip-Ring, illustrated on the right, shows how Metaplating eliminates a ticklish assembly job. Close fitting Slip-Rings are plated into a one piece plastic insulator.

Metaplast COMPANY

METAPLAST Process Patented U. S. and Foreign Patents TRADE MARK REGISTERED

205 West 19 Street New York 11, N. Y.

Metal Plating on Plastics

★

Precision-Built

PLASTIC ★MOLDS★

INJECTION, COMPRESSION, OR TRANSFER TYPE

1 Our customers (list on request) include many of America's most prominent molders.

2 In our organization are nationally-known authorities on plastic molds and molding.

3 Expanded facilities insure prompt delivery. Your inquiry will receive immediate attention.

esc Engineering Specialties Corporation

3476 Gibson, Detroit 1, Mich.

Raymond Laboratories BOOST OUTPUT OF PLASTIC MOLDS

● This modern factory, Raymond Laboratories, boosts production of plastic molds through use of Despatch ovens for preheating plastic pre-forms. This recirculating type oven is speedy and maintains even temperature throughout. Automatic temperature control requires no attention from operator.

Photo shows standard model. Other models available with swinging flap-doors or removable drawers. Write for details today.

PROMPT DELIVERY ON AA3 ORDERS!

DESPATCH OVEN COMPANY MINNEAPOLIS

THERMOPLASTIC *SCRAP* **MATERIALS**

Leading the field for more than 20 years!

PLASTIC MATERIALS

Headquarters—

for reclaiming Thermoplastics including

ACETATE BUTYRATE ETHYL CELLULOSE
STYRENE & ACRYLIC OR VINYL RESINS

We Reprocess *for* You or Buy *from* You:
We reclaim thermoplastics that are off-size or off-standard, including factory residues or scrap.

Turning Waste into Usable Materials:
We are a source of supply for manufacturers who need clean and graded re-processed plastics. These are suitable for many applications where VIRGIN materials are not essential or *cannot be obtained.*

GERING PRODUCTS INC.

North Seventh St. & Monroe Ave., KENILWORTH, N. J. Chicago Office: 622 W. Monroe St.

Patented Construction Won't Pull Out

Patented construction of famous "Safety Strain" insulators is guaranteed against failure under great stresses. These insulators will withstand unusual vertical and horizontal tension. The entire insulator may disintegrate but the inserts never pull apart.

"Safety-Strain" insulators are manufactured of our own special material, giving the finest electrical insulation. "Safety-Strain" insulators are made in a complete range of sizes.

In addition to producing stock moldings, Insulation Manufacturing Company is well known for its custom, precision molding for all industries. Write or phone our engineers.

INSULATION MANUFACTURING CO.

CUSTOM MOLDERS OF PLASTICS FOR INDUSTRY

11 New York Avenue Brooklyn, N.Y.

We're Singing a Song of Plastics

Ideal

A SYMBOL OF FINEST CRAFTSMANSHIP IN PLASTICS

ENGINEERED BY IDEAL FOR YOU, INJECTION-EXTRUSION MOLDED, PRECISION MADE . . . AND TRUE.

Yes, we're waxing poetic . . . because we're feeling good — because everyone tells us our work is tops. And no wonder — here at Ideal Plastics, our entire production and engineering staff are devoted to the principle of perfection in plastics.

IDEAL PLASTICS CORPORATION

A DIVISION OF IDEAL NOVELTY & TOY CO., INC
23-10 43rd AVE., LONG ISLAND CITY, N. Y.

PHENOPREG *Grades for*

Specification Laminated Phenolic Stocks

For the production of laminated phenolic to meet Federal Specifications HMP-256 we offer the following PHENOPREG grades:

TYPE I

Natural Color	Grade X	Grade XX	Grade XXX
Core or filler	No. 215	No. 196	No. 185
Surface sheet	No. 216	No. 185	No. 185
Black Color			
Core or filler	No. 217	No. 220	No. 219
Surface sheet	No. 218	No. 219	No. 219

TYPE II

Natural Color	Grade C	Grade CE	Grade L
Core or filler	No. 126-A	No. 181	No. 148
Surface sheet	No. 146	No. 182	———
Black Color			
Core or filler	———	No. 221	———
Surface sheet	———	No. 222	———

PHENOPREG materials laminate under the application of heat and pressure

DWP

Vinewood 1-8200

DETROIT WAX PAPER CO.

PLASTICS DIVISION

1721 Pleasant Avenue, River Rouge 18, Michigan

THE NEW MISKELLA Infra-VIBRA-VEYOR

For Pre-Heating and Drying Plastic Powders!

MANY OUTSTANDING FEATURES!

- Fully inclosed with easily removable panels.
- Detachable 75 pound hopper with adjustable gate.
- Heavy metal vibrator trough 15' wide with electronic variable flow control.
- Calibrated auto-transformer, operative from either side of machine, provides perfect heat control.

- Capacity sixty pounds per hour.
- Lamp-Saver Shock Absorbers.
- Blower fan pushes fumes out through wide fireplace type chimney.
- Handle pans, one above the other, hold ten pounds each. Also removable from either side.

INFRA-RED INSULATED REFLECTIVE HEAT

- Detachable from Bench-Truck for over hopper suspension. Angle feed trough furnished to deliver material from either side. Insulated-Reflective Infra-Red eight lamp heat panel with 4 switches for 500, 1000, 1500 or 2000 watts.

MANUFACTURED BY

INFRA-RED ENGINEERS & DESIGNERS

1633 E. 40th Street — Cleveland 3, Ohio

Have you got any

BLOODHOUND BLOOD?

Unless you have that old tracking instinct that goes with drooping ears and a long nose, you probably want to spend as little time tracking down deliveries and "reasons why-not" as possible.

When you order something from your molder—if your molder happens to be us—you will not have to develop any hunting instincts to make sure your work gets out on time, gets to you on time, or is the way you want it to be.

We guarantee you will like our work and that you will not have to sic your dogs on us. Mack Molding Company, Wayne, New Jersey; Arlington, Vermont; Waterloo, P. Q., Canada.

Mack

MOLDED EXCELLENCE

FABRICATED
Graphic
LAMINATES
LAMICOID FABRICATORS, INC.
durable sheet material in which printed lettering, designs, or diagrams in black, white, and colors are permanently laminated; cannot remove or erase. Opaque or Translucent.
3600 Potomac Av • Phone: CAPitol 1500 • Chicago 51, Ill.

LAMICOID FABRICATORS INC.

Midwest Fabricators for Mica Insulator Co.

Specialists in fabricating laminated phenolic materials • fibre and papers • Engraved and Graphic Lamicoid

LAMICOID LF FABRICATORS

JOEY-ON-THE-JOB SAYS...

JOMAC
HEAT-RESISTING GLOVES

Workers in PLASTICS *praise these special protective gloves*

A special pile-knitting machine achieves these gloves which are guarding the hands of workers in plastics . . . and the gloves are particularly helpful in the handling of hot molds. This extraordinary Jomac fabric is a loop-finished cloth that is thick with air-cells which dissipate heat. Sturdy and extra-long wearing, too. Jomac Gloves can be laundered repeatedly, *kept clean* . . . thus guarding workers against skin infections.

TEST THEM!

Try JOMAC GLOVES on your stiffest jobs. Test them for heat-resistance, for wear, for washability, for economy, for *increased production*. Write for full details.

JOMAC
INDUSTRIAL GLOVES

C. WALKER JONES CO.
6135 N. Lambert Street
East Germantown, Philadelphia 38, Pa.

FOR THE AGE OF PLASTIC MIRACLES

MIRACLE ADHESIVES

BOND . . .
JOIN . . .
FASTEN . . .

RIGID PLASTICS
Glass • Metals • Wood
without
HEAT or PRESSURE
and
WITHOUT SCREWS, NAILS, BOLTS, SHIELDS OR CLIPS

Consult us if you have a bonding problem

MIRACLE ADHESIVES CORP.
261 Fabyan Place, Newark, N. J.

DO YOU KNOW . . .
All of the Advantages of Infra-Red Ray Drying with **NALCO DRITHERM**

Carbon Filament Lamps?

Remove Moisture from Plastics Quickly and Cheaply with Nalco Infra-Red Lamps

Use Nalco Dritherm Lamps for efficient results . . . available in Inside-Silvered (self-reflecting) or clear glass types.

Learn all of the advantages of the Infra-Red process for plastic dehydration.

Write for your free copy of "Drying Problems Made Easy" today.

Exterior of Infra-Red Conveyor Belt Tunnel for removing moisture from plastic material prior to molding.

Sides dropped to show arrangement of Infra-Red light bank and materials passing under light conveyor belt.

North American Electric Lamp Co.
1012 Tyler Street St. Louis 6, Missouri

NALCO

DESIGNED for Service

Wherever the K & J Trade Mark is seen, there you will find convincing proof of efficiency in

HIGH GRADE PLASTIC MOLDING

ESTABLISHED 1919 — TRADE MARK

KUHN & JACOB MOLDING & TOOL CO.

1200 SOUTHARD STREET, TRENTON 8, N. J.
TELEPHONE TRENTON 5391
55 WEST 42nd STREET, NEW YORK 18, N. Y.

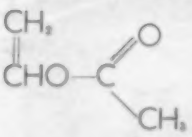
Plastic Molding

MacRae's
Blue Book
CLOSING NOW
Condensed—for your and your customers' purchasing needs. Elastic—for your advertising. For book price and space rates, write Dept. F.
MacRae's Blue Book
A DIRECTORY OF AMERICAN INDUSTRY
18 E. HURON STREET • CHICAGO
OFFICES IN PRINCIPAL CITIES

UNPOLYMERIZED

VINYL ACETATE

(STABILIZED)



Purity 99.5% Boiling Range 71.8° to 73° C.

Vinyl Acetate can be polymerized to form resins with exceptional bonding qualities for wood, glass, metal and fibre.

Containers:—

410 lb. drums; 62,500 lb. tank cars

For further information write to:

NIACET

CHEMICALS CORPORATION
4740 PINE AVE. NIAGARA FALLS, N. Y.

COTTON FABRICS

FOR REINFORCING

PLASTICS

★

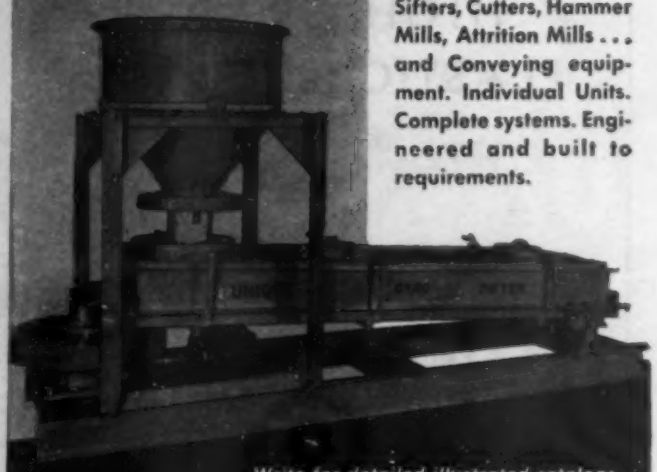
J. H. LANE & CO., Inc.

250 W. 57th St. · New York, N. Y.

UNIQUE

Materials PROCESSING EQUIPMENT

Unique processing machinery for rubber, reclaims, plastic materials, fillers and blends . . . comprises Mixers, Sifters, Cutters, Hammer Mills, Attrition Mills . . . and Conveying equipment. Individual Units. Complete systems. Engineered and built to requirements.



Write for detailed illustrated catalogs

MERCER-ROBINSON COMPANY, INC.

30 CHURCH STREET, NEW YORK 7, N. Y.

You Can DAM THE EXPENSE

WITH

HOBBED Cavity MOLDING

Tomorrow — the element of unit cost is going to be a prime factor in the production of plastic items. And — it's important today, too. We'd like to tell you about our experience in money-saving hobbing over a period of 25 years.

NEWARK DIE COMPANY, Inc.

20-24 SCOTT ST. NEWARK, N. J.

Telephone — MARKET 2-3772, 2-3773

ORGANIC PEROXIDES

CATALYSTS FOR POLYMERIZATIONS
DRYING ACCELERATORS · OXIDATION AGENTS · BLEACHING AGENTS

LUCIDOL®
(BENZOYL PEROXIDE)

LUPERCO®
(PEROXIDE COMPOUNDS)

ALPEROX®C
(TECHNICAL LAUROYL PEROXIDE)

SPECIAL ORGANIC PEROXIDES

® REGISTERED TRADEMARK

LUCIDOL CORPORATION

BUFFALO (5) N. Y.

WE build molds for all plastics

More than 20 years of successful experience as toolmaker to leading custom and proprietary molders qualify us as your mold designer and mold maker on your most exacting jobs of plastics engineering.

Fortney MANUFACTURING COMPANY
MOLDS FOR PLASTICS

247 N.J.R.R. AVE. ★ NEWARK, N. J.

TO END ALL CORROSION PROBLEMS

Saran is a tough thermoplastic originally made to replace such strategic war materials as aluminum, stainless steel, nickel, copper, brass, tin and rubber. Now found adaptable to a wide range of uses in product designing, food processing and wherever non-corrosive materials are necessary. Its insulating qualities, flexibility and ease of handling make it extremely valuable in installations dealing with oils, gases, air, water and corrosive chemicals. It is available in tube, pipe, sheet, rod and molded fittings.

Technical Bulletin P-8 will be sent on request. Address Dept. SA

Pat. No. 2160931

HODGMAN RUBBER CO.
FRAMINGHAM, MASS.
NEW YORK . . . . 261 Fifth Avenue
CHICAGO . . . . 412 South Wells St.
SAN FRANCISCO . . . 121 Second St.

HOLTITE —Phillips— RECESSED HEAD SCREWS & BOLTS

Effect Savings In ASSEMBLY TIME UP TO... 50% and more

Yes, HOLTITE-Phillips Screws and Bolts cut assembly time an average of 50% with a comparable saving in cost. Now the accepted, time-proven fastening practise in all plants striving for smooth, uninterrupted production, these modern recessed head screws and bolts provide many additional advantages and improvements. Power drivers can be used on more jobs . . . Pilot holes eliminated for stronger fastening . . . Easy driving in difficult positions and angles . . . Fewer screws required, or smaller sizes used on same operation. Other definite advantages are obtained from HOLTITE-Phillips fastenings to improve your assembly and speed production. Specify HOLTITE on your next order.

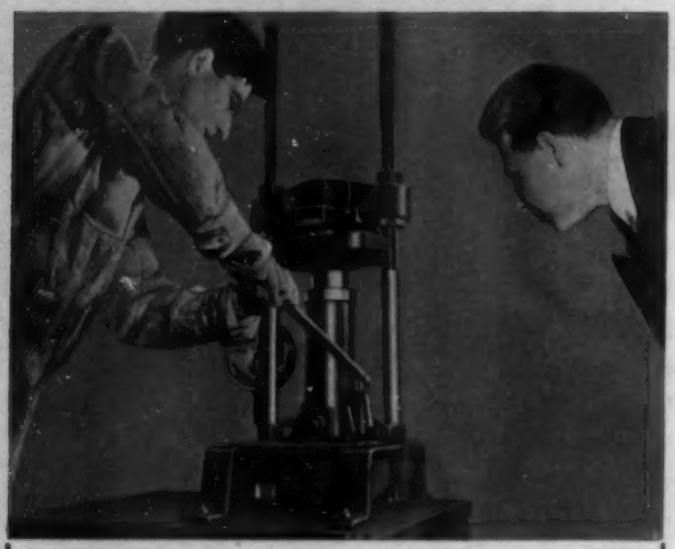
Specials

With complete equipment and facilities for producing Special parts and fastenings, we can efficiently meet any requirement, exact to specifications. Send blueprint, specifications or sample.

CONTINENTAL SCREW COMPANY

The CARVER LABORATORY PRESS

STANDARD FOR RESEARCH AND DEVELOPMENT



. . . . IN THE COOPER UNION

The crushing power of the Carver Laboratory Press is here being put to use in the metallurgical laboratories of the Cooper Union Schools of Engineering in New York City. An instructor and one of his students are shown compressing metal powder, one of the hundreds of experiments performed with the aid of the Carver Laboratory Press.

This press has been long used in plastics research by leading firms, colleges and government laboratories. It is the standard press for making quick and accurate small-scale pressing tests; for development, research and instruction work; for testing single cavity molds; preparation of samples, and even for small scale production.

Original in design, the Carver Laboratory Press is small, compact,

- –has a pressing capacity of 20,000 lbs.
- –weighs only 125 lbs.
- –operates with self-contained hydraulic unit.
- –large accurate gauge of finest construction is rigidly mounted on base.
- –special gauges are available for low pressure work.

Accessories include steam and electric hot plates and test cylinders or molds. Also standard interchangeable accessories for general research–cage equipment, bearing plates, filtering equipment, etc. The press and certain of the accessories are patented.

PROMPT DELIVERIES . . . *Send for latest catalog.*

FRED S. CARVER
HYDRAULIC EQUIPMENT
343 HUDSON ST., NEW YORK 14

COLORS

LIGHT FAST
and
PERMANENT
REDS—YELLOWS—BROWNS

SYNTHETIC
IRON OXIDES

REICHARD-COULSTON, INC.
15 East 26th St.
New York 10, N. Y.
Factory—BETHLEHEM, PENNA.

POST WAR PLASTIC SALES

. . . A sound capital structure is required to finance broad post war markets. Alert management is investigating factoring —the streamlined banking of prosperous industry.

BOOKLET ON REQUEST

COLEMAN & COMPANY

FACTORS • ESTABLISHED 1912

468 FOURTH AVENUE • NEW YORK CITY

MOULD MAKERS AND MOULDERS

If you have any full or part time available for the making and running of compression or injection moulds, get in touch with us.

HARRY BRODER CREATOR AND DISTRIBUTOR OF COSMETIC CONTAINERS

5 EAST 47th STREET, NEW YORK, N. Y. • PL 8-0520

Stamp NAMES • DESIGNS TRADEMARKS

in Gold, Silver, Colors on Plastic Products

Precision stampings—positive, clean-cut, enduring—can now be done with ordinary girl operators at production speeds up to 1,000 pieces per hour. Write for catalogue, or submit your stamping problems.

Kingsley GOLD STAMPING MACHINE CO.

★ HOLLYWOOD, CALIFORNIA ★

INORGANIC PIGMENTS *for plastics*

- INSOLUBLE
- HEAT AND LIGHT RESISTANT

Let us know the application . . .
Color samples supplied on request.

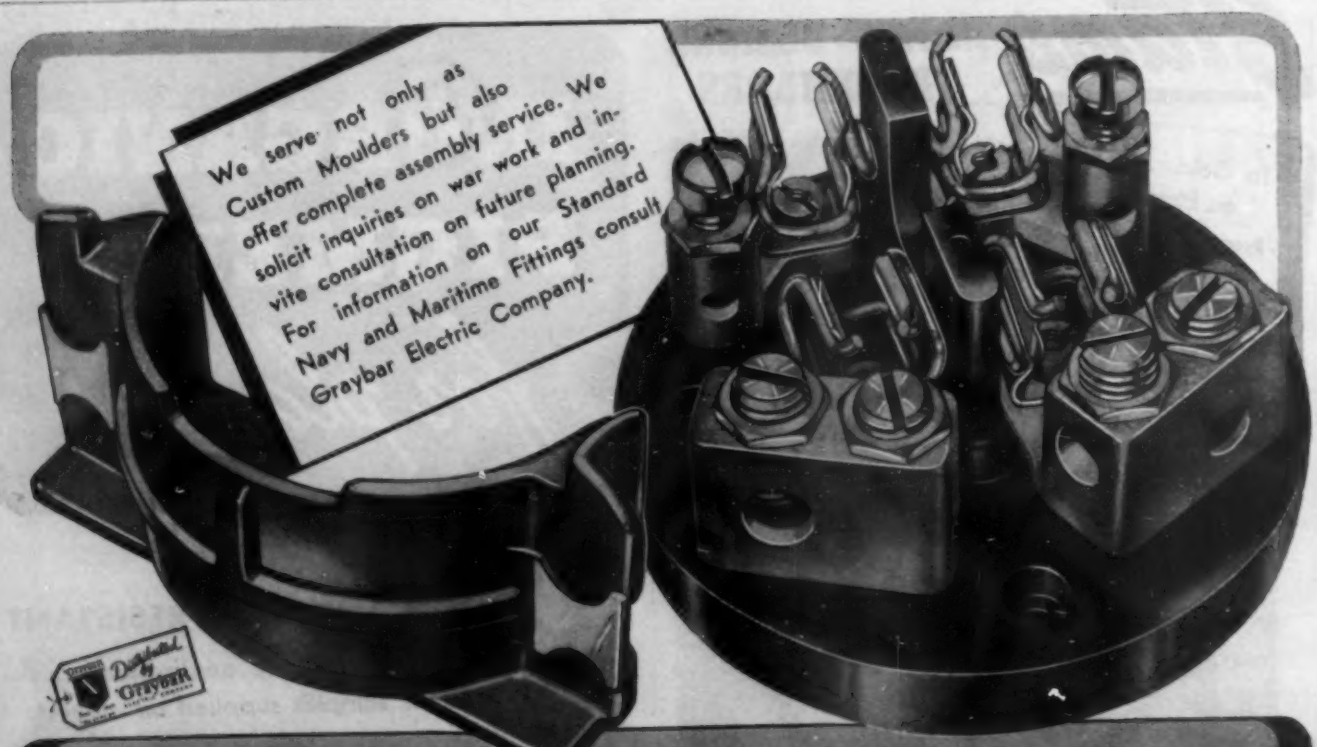
WRITE B. F. DRAKENFELD & CO., INC.
45-47 Park Place, New York 7, N. Y.

Drakenfeld

Plastics SCRAP
WILL HELP WIN THIS WAR

We specialize in the reworking of
rejected molded parts
obsolete molding powders
or molding scrap
into solid colors of a good molding powder
in any desired flow

A. BAMBERGER
Plastics Molding Materials
109 SOUTH 5th STREET BROOKLYN, N. Y.
Cable: Chemprod — Telephone: EVergreen 7-3887


We serve not only as
Custom Moulders but also
offer complete assembly service. We
solicit inquiries on war work and in-
vite consultation on future planning.
For information on our Standard
Navy and Maritime Fittings consult
Graybar Electric Company.

Northern Industrial Chemical Company
7-11 ELKINS ST., SO. BOSTON 27, MASS.
35 YEARS OF PLASTIC MOLDING EXPERIENCE

CONTRACT

PLASTICS MOLDING

INJECTION AND COMPRESSION MOLDING IN ALL THERMOPLASTIC AND THERMOSETTING MATERIALS

EXAMPLE OF WIDE SIZE RANGE

We have the set-up and experience to give you the best in plastics molding of small and large parts, in small or large quantities, at reasonable prices

QUOTATIONS on specific requirements without obligation

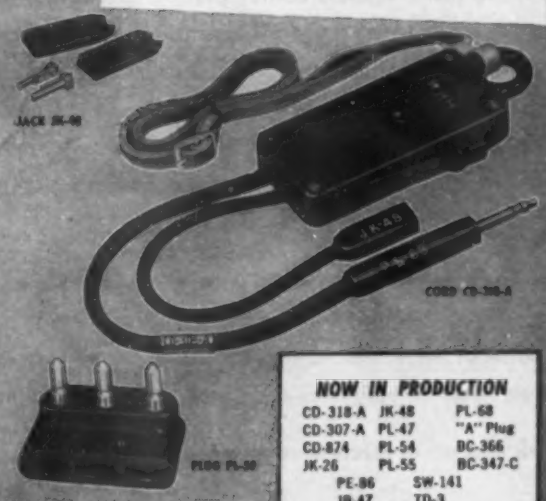
S.S.WHITE PLASTICS DIVISION

THE S. S. WHITE DENTAL MFG. CO. — DEPT. M, 10 EAST 40th ST., NEW YORK 16, N. Y.

FLEXIBLE SHAFTS · AIRCRAFT ACCESSORIES · MOLDED PLASTICS · MOLDED RESISTORS · FLEXIBLE SHAFT TOOLS

PROMPT DELIVERY

Interphone Equipment and Component Parts



NOW IN PRODUCTION		
CD-318-A	JK-48	PL-68
CD-307-A	PL-47	"A" Plug
CD-874	PL-54	BC-366
JK-26	PL-55	BC-347-C
PE-86	SW-141	
JB-47	TD-3	

TRAV-LER KARENOLA

RADIO AND TELEVISION CORPORATION

1026 W. VAN BUREN ST., CHICAGO 7, ILL.

Plastics from VICTORY*

FOR *Victory!*

Ours is the plant behind many plants . . . molding plastic parts for numerous contractors who are supplying the Navy, the Army Air Forces, and the Signal Corps.

Molding millions of precision plastic parts for the Armed Forces is still our big job, but we have the time, the equipment and a highly skilled staff to handle a limited number of new contracts—and do a better molding job, *on time.*

Whether for production now, or after the War, our engineers are ready to work with you immediately. Write us today and let us know your molding problems.

Member: Society of the Plastics Industry

AUTOMATIC INJECTION MOLDING

Small and large parts

UP TO 17-OZ. SHOTS

Lumarith, Tenite, Fibestos, Plastacelle, Crystallite, Lucite, Ethyl Cellulose, Polystrene, Lustron, Styron, Vinylite, Loalin, Cellulose Acetate and others . . . all molded to your exacting specifications.

*VICTORY MANUFACTURING COMPANY

1722 W. Arcade Place, Chicago 12, Ill.

ESTABLISHED 1930

PLASTIC BRANDING
PLASTIC MOLDING } by Rogan

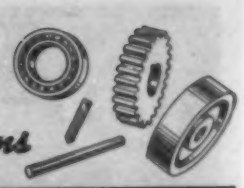
While molding and branding plastics that serve on all battle fronts, Rogan is also preparing for the peace that will follow. Preparing to meet the demand from peacetime industry for the many NEW applications of plastics. And, when Peace does come, get Rogan facts on how you can get *faster* production of plastic parts at *less* cost.

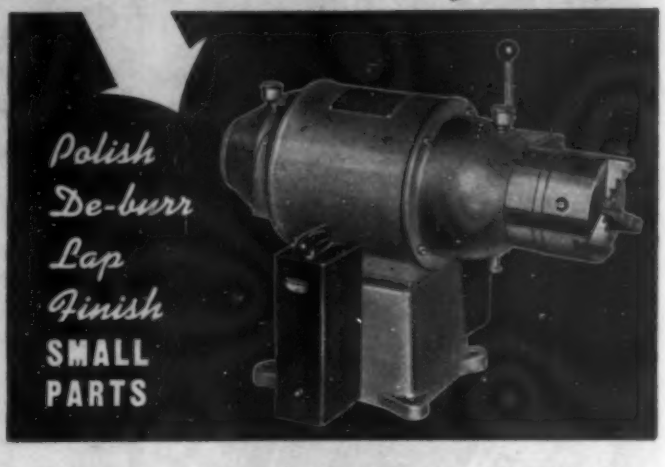
Write now about your present War plastics and future Peace products

ROGAN BROTHERS

2005 S. Michigan Avenue — CHICAGO, ILLINOIS

SPEED LATHES *for Secondary Operations*





Schauer Ideal Speed Lathes insure finer quality, greater accuracy and uniformity, coupled with increased output and lower cost. A size and type for every finishing purpose. State YOUR finishing problem. Write for Catalog 440.

SCHAUER MACHINE COMPANY

ORIGINATORS OF TODAY'S SPEED LATHES
2077 READING ROAD --- CINCINNATI 2, OHIO

EVENTUALLY... BUT NOT NOW

When the war is won—invasion over—the vast experience that we have gained in the development of molded plastics for war production will be yours for the asking. Our representatives will be pleased to help you modernize and improve the appearance of your post-war products.

Write for additional information

Custom CONNECTICUT *Plastics* Molders

CONNECTICUT PLASTIC PRODUCTS CO.

70 WEST LIBERTY STREET — WATERBURY, CONNECTICUT

INDIA NOW AND POSTWAR

To those manufacturers contemplating extending their export market to rapidly expanding British India excellent opportunities are offered through the medium of The Industrial & Commercial Trust Limited —an experienced well-established Company, financially sound with extensive ramifications throughout the country—to further that end.

This Company is prepared to consider the sole agency for India for machine tools, cutting tools, plywood and plastics of all kinds. Domestic radio, apparatus and accessories, automobiles and parts, and kindred lines.

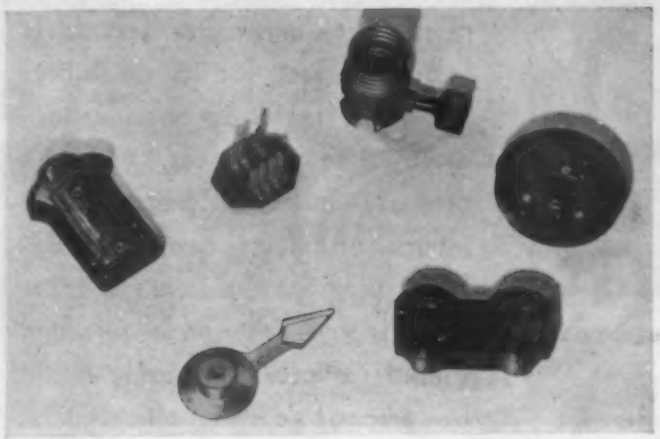
Bank and other references submitted.

Communicate direct to:

THE INDUSTRIAL AND COMMERCIAL TRUST LIMITED

WAVELL HOUSE, 15 GRAHAM ROAD
BALLARD ESTATE, FORT, BOMBAY

Are YOU specialists in your particular line?



If so, you will understand when we say:

IN THE TUBULAR RIVET FIELD . . . IT'S MILFORD!

IMPORTANT savings in time and production costs are possible in assembling electrical parts with tubular rivets.

Here, for instance, is a check list of outstanding advantages secured through the use of tubular rivets.

1—Can't unscrew or shake loose through vibration or shock.

2—Insure maximum tightness—permanently.

3—Applied quickly, easily and cheaply.

4—Available in various metals and alloys.

5—Economical in cost as compared with other fastening devices.

6—Can be used with plastics, felt, cloth, wood, leather, rubber—alone or in combination—in addition to metal.

7—Close control of pressures during riveting operations (with tubular rivets).

Tubular rivets are our specialty. We will gladly place at your disposal the accumulated knowledge and experience of our technical staff.

The Milford Rivet & Machine Co.

Post Road, Milford, Connecticut

and

GENERAL RIVET & MACHINE DIVISION, ELYRIA, OHIO

Symbol of EFFICIENCY AND PRECISION

The *f* of Franklin symbolizes all of the qualities you desire in plastic molding.

Franklin offers you precision Plastic molded parts with production performance by a highly efficient, well trained personnel.

You can achieve maximum quality, and receive helpful assistance in planning on your present or your next plastic job by contacting Franklin.

You'll want your next job to carry this symbol *f*

★ ★ ★

ARMY E NAVY

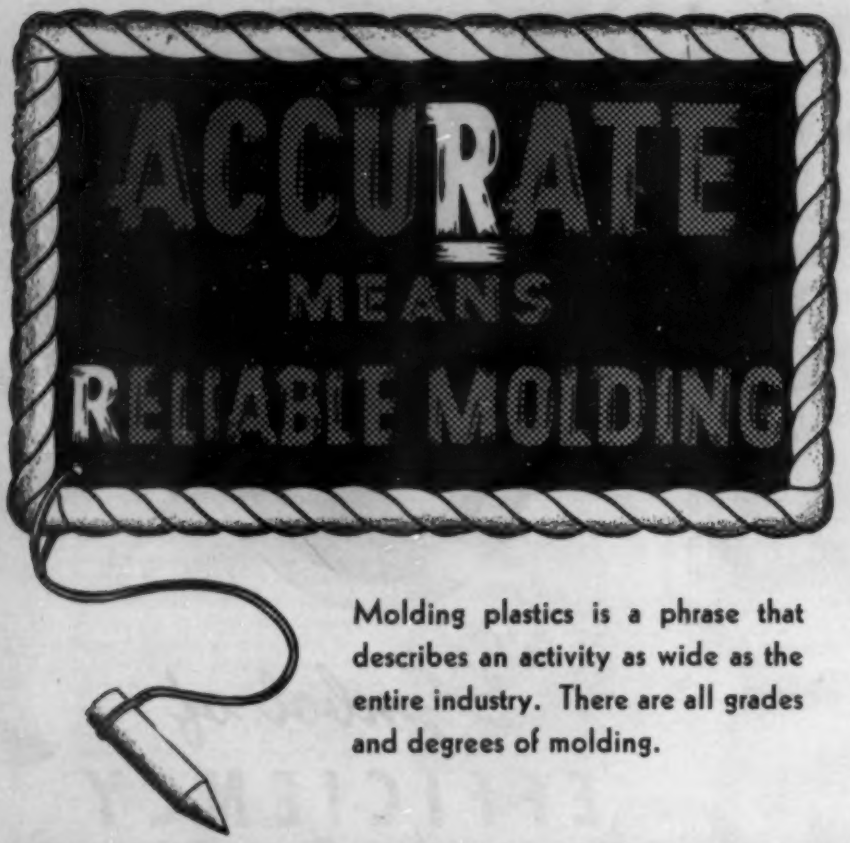
Buy WAR BONDS AND STAMPS

★ ★ ★

Franklin

FRANKLIN PLASTICS DIVISION

Robinson Industries, Inc. - - FRANKLIN, PA.



Molding plastics is a phrase that describes an activity as wide as the entire industry. There are all grades and degrees of molding.

Accurate specializes in reliable plastic molding. Our service is known, in fact, for its reliability. We make molds to specification, meet close tolerances, turn out properly cured moldings without internal or external flaws. Our delivery promises are kept. If reliability is your criterion in selecting a molder, Accurate Molding should be among your suppliers. Our engineers will be glad to consult with you on any of your current or future requirement.

ACCURATE MOLDING CORPORATION
116 NASSAU STREET • BROOKLYN, NEW YORK

MOLDED PLASTICS
FOR WAR-TIME AND PEACE-TIME PRODUCTS

IF you have a plastic problem we invite you to take advantage of our complete facilities—Engineering and Drafting—Machine Shop—Molding dies and Molding—every operation from the drafting board to the finished molded products.

We specialize in Compression and Transfer molding of Thermosetting plastics—Mechanical rubber products to specification—and Laminated materials.

Your inquiry will be treated in strict confidence —and without obligation, of course.

TAYLOR MANUFACTURING CO.
3084 WEST MEINECKE AVE. • MILWAUKEE 10, WIS.

PLASTICS OF
PREDETERMINED FITNESS

THREAD
MOLDING
TUBING
TAPE

SEND FOR BOOKLET
AND SAMPLES

NATIONAL PLASTIC PRODUCTS Company
ODENTON, MARYLAND

All classified advertising payable in advance of publication. Minimum, $5.00 (up to 60 words); in border, $10.00 per inch.

Classified Advertisements

For further information address Classified Advertising Dept. MODERN PLASTICS 122 East 42nd St., New York 17, N. Y.

AN OPPORTUNITY for an able, energetic Plastics Chemist or Engineer having a large general knowledge of application work particularly in laminating and bonding with thermosetting resins and capable of supervising development work. Reply Box 1007, Modern Plastics.

PATENT ATTORNEY specialized in plastics wants part time job in New York City or vicinity. Reply Box 1008, Modern Plastics.

Arthur Swanson & Associates

PRODUCT DESIGN

Executing designs for post-war manufacturing.
540 N. Michigan Ave., Chicago 11, Ill.

FOREMAN MACHINE SHOP—Over draft age or draft exempt. Preferably experienced in Plastics—as well as metals. Completely responsible for design and execution, machinery, molds, dies, jigs and fixtures. Aggressive trouble shooter in novelty mass production; well disciplined temperament absolutely essential. Adequate compensation, splendid opportunity. Write Box 1009, Modern Plastics.

WANTED: PLASTIC SCRAP OR REJECTS in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

WANTED MOLDING PLANT ENGINEER: Man with practical experience in mold design with knowledge of injection and compression molding methods. Knowledge of finishing desirable. Permanent position for right man. Location: Staten Island Plant. Apply or write with full details of draft status, experience or schooling, salary, to S. S. White Dental Mfg. Co., 10 East 40th Street, New York 16, N. Y.

WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Acrylic and Vinyl Resin materials. Submit samples and details of quantities, grades and color for our quotations. Reply Box 508, Modern Plastics.

MANAGEMENT ENGINEER: Extensive experience in Plastics, Business Administration, Costs, Production, Methods, Wage Incentives and Products. Married. Position must afford plenty of responsibilities. Desiring permanent position with post-war opportunities. References and resume upon request. Reply Box 1010, Modern Plastics.

FOR SALE—1 Worthington Hyd. Pump 1 x 6, 5 GPM 6000# pressure M.D. 1 Hyd. Press 24" x 24", 14" ram; 1 Battery of 2—15 x 36 compounding rolls with drive at 75 HP motor; 1 W. S. 15" x 18" Hyd. Press, 10" ram; 1—14" x 24" Press, 9" ram; 4—24" x 55" steel cord Heating Platens; 4—W. & P. Mixers; 4—Semi-Automatic 100-ton Hydr. Presses, platen area 20" x 36"; Allen 6" Tuber; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box 447, Modern Plastics.

POSITION WANTED—Chemical Engineer, 21, Draft status 1AL (available for industry) desires position doing research and development work in plastics, synthetic fibres; postwar. Experienced in low pressure moulding, radar housings; phenolics, ureas, melamines, allyl resins. Have developed resin for high frequency work. Location anywhere, have release. Reply Box 1011, Modern Plastics.

FOR SALE: 1—500 ton Hydraulic Press with downward moving ram and pushbacks. Box 512, Modern Plastics.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

WANTED—Lupomatic or similar rod slicing machine, suitable for slicing rod celluloid. Advise stating when purchased, condition and price. Reply Box 1012, Modern Plastics.

POSITION WANTED—Foreman wants position with progressive organization desiring the service of a man thoroughly experienced in molding and production of thermosetting materials. Knowledge of presses and dies for compression and transfer molding. Reference available. Draft exempt. Reply Box 1013, Modern Plastics.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

FABRICATOR OF PLASTICS has facilities available for small jobs and production work. War and essential items given preference over non-essential. We specialize in Lucite and Plexiglas. House of Plastics, 2323 Michigan Ave., St. Louis 4, Mo.

ATTENTION

Have you any idle pre-war compression molds? We are interested either through rental or purchase, in compression molds formerly employed in a substantial production of pre-war non-military articles. Please give all particulars in replying to Box 1014, Modern Plastics.

FOR SALE: Hydraulic Presses, 4—36" x 36" 12" ram, 1—20" x 80" 4-8" rams, 1—52" x 26" 14" ram 400 ton cap., 1—15" x 15" 10" ram, 1—14" x 14" 8" ram, 6—12" x 12" 6" ram, 1—18" x 20" 14" ram, 2—30" x 52", 1—with 15" ram, 1—with 6" ram 3 openings, 1—5B 15" x 17" Toggle, 2—14" x 20" Combination Hydraulic Toggles, 14" x 20" 100 ton cap. Pumps: 1—Watson Stillman duplex high and low pressure ¾ GPM 4000 lbs. continuous bedplate, Elmes horizontal triplex 1¼ GPM 4000 lbs., Hele Shaw JLP 44 GPM 1200 lbs., HPM triplex 1¼ GPM 2000 lbs. on high 16 GPM 4000 lbs. on low V Belt Drive, Robertson Triplex 5 GPM 5000 lbs., Union Steam Pump Viscolizer 3 GPM 3000 lbs., Gould Triplex 35 GPM 1500 lbs. Accumulator weighted type 6" dia. ram 6' stroke, Vulcanizers, Extruders, Mixers, Mills, etc. Advise your Requirements. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 285 Hudson Street, New York 13, New York.

AVAILABLE—Plastic engineer and executive with twenty years custom molding experience on injection and compression machines. Experience covers mold design, construction, tools, jigs, fixtures, cost estimating, production and plant management. Positions held shop supt. production and plant manager. Reply Box 1015, Modern Plastics.

CUSTOM COMPRESSION MOLDING

A manufacturer desires to contact custom molders having available press capacity with a view to production of substantial quantities of small compression molded parts or articles. Reply Box 1016, Modern Plastics.

WANTED—AN ENGINEERING EXECUTIVE

A strong, well established, and progressive custom molder, located in the Middle West, requires the services of a seasoned engineer. Must know the molding of thermosetting and thermoplastic materials, as well as mold fabricating methods and costs. This position calls for a high calibre man, and pays accordingly. Please give full details in first letter. Address Box 1017, Modern Plastics.

EASTERN CANADIAN SALES REPRESENTATIVES with excellent connections, seeks to establish business relation with plastic manufacturers for now and post war period. Plastic Commodities Company, 623 Notre Dame West, Montreal, Que., Canada.

FOR SALE: ½" Preform Tablet Machine; W. S. Hydr. Press 12" x 12", 6½" Ram; 2—Burroughs 12" x 12", 7¾" Rams; 2—15" x 15", 7½" & 8½" Rams, Heated Platens; 24" x 36", 6" Ram; 22" x 24", 5½" Ram; 25" x 36", two 5" Rams; 48" x 26", four 3½" Rams; 78" x 36", two 7½" Rams; Farrel 30" x 23" Heated Platens, 8" Ram; Farrel 24" x 24", 10" Ram, Heated Platens; Thropp 24" x 24", 10" Ram, Heated Platens; 400 ton Hydraulic Extrusion Press; 1—Royle #2 Extruder or Tuber; Faust 150 gal. heavy Double Spiral Jack. Mixer; 3—New Ball & Jewell Rotary Cutters; Large stocks of Hydraulic Presses, Pumps & Accumulators, Mixers, Grinders, Pulverizers, Gas Boilers, etc. Only Partial Listing. Send us your inquiries. We also buy your surplus machinery. Stein Equipment Co., 426 Broome St., New York 13, N. Y.

PLASTICS ENGINEERING EXECUTIVE

Unusual background and accomplishments, interested in connection with progressive national organization in New York, Chicago or Detroit area. Operate or establish manufacturing unit in laminated molded plastics or other reinforced thermosetting materials. Partnership in new business unit considered. Able to assume complete responsibility and show profitable results creating new product lines, materials, processes, equipment and tools. Thoroughly familiar with costs, profit analysis and operating controls. Principals only, kindly state nature of products, results expected and plan of compensation. Box 1018, Modern Plastics.

MANUFACTURERS—MOLDERS—ATTENTION!!! New Patent—For Sale or Royalty. Combination—Water Filter, Spray, Anti-Splash, Purifier, Size 2¼" x 3". Molded of Plastic. Adaptable to any size kitchen faucet. Sales thru chain, syndicate or department stores. $1.00 retailer. Volume could readily reach several millions. Can be used for photographic developing where clear filtered water is necessitated. Reply Box 1021, Modern Plastics.

INJECTION MOLDER interested in buying additional molding facilities, Injection, Compression and Extrusion. Box 967, Modern Plastics.

LIVE ORGANIZATION WANTS FOLLOWING

To purchase for cash, small injection plant or machinery, ideas or patents adaptable to plastics manufacture. Will finance development.

WILL REPRESENT IN MIDDLE WEST, FIRMS HAVING PRODUCTS SELLING TO ANY TYPE BUYER. AGGRESSIVE RELIABLE REPRESENTATION BY EXPERIENCED MEN.

Write George D. Nichols, President
INDUSTRIAL PLASTICS CORPORATION
161 W. Wisconsin Avenue Milwaukee 3, Wisconsin
Manufacturing Engineering Marketing

DRAFTSMAN & TOOL DESIGNER

Experienced in design of compression and injection molds, also jigs and fixtures. Experience in product development desirable. Reply Box 981, Modern Plastics.

MANUFACTURERS FABRICATORS
INVENTORS MOLDERS

Have you a product you want marketed? How many do you want sold per year?

WE specialize in MARKETING, MERCHANDISING, and SALES PROMOTION through drug and variety chain stores and department stores, nationally.

We operate on a commission basis, or we guaranty to purchase a definite amount per year, in bulk or packaged.

Send sample and details, please. Box 1020, Modern Plastics.

MANUFACTURERS of molded plastic articles with engineering staff are requested to contact us for the purpose of consultation and production of articles sold in large quantities before the war. Write or call to see Mr. Max Ingwer. Consolidated Sewing Machine & Supply Co., 1115 Broadway, New York, N. Y.

FOR SALE—Lucite molding powder (HM-109) as follows:

235 lbs. H-10343 White
467 lbs. H-10344 Green
584 lbs. H-10022 Black
2112 lbs. H-10341 Red.

Entire amount 60¢ per pound, f.o.b. Kansas City.
Reply Box 1019, Modern Plastics.

PRODUCT ENGINEER, familiar with compression and injection molding. Must have customer contact experience. Permanent position with successful organization. Good postwar outlook. Write full details of qualifications, salary expected. Reply Box 1022, Modern Plastics.

FOR SALE—Clear Acrylic Resin Scrap Sheet Stock (Plexiglas) available in thickness of ⅛, 3/16, and ¼ inches. This sheet stock is packed in selected sizes of the same thickness in both formed and flat stock. Reply Box 1031, Modern Plastics.

PLASTICS ENGINEER with valuable Pacific Coast Aircraft and furniture connections, has well financed sales organization. What have you to sell? Box 425, Wilmington, California.

WANTED: Man to take charge of Toolroom.. Must have had tool building and design experience and be skilled. Fine opportunity with reliable Plastic Moulders. "Prefer man about 45." Reply Box 1024, Modern Plastics.

INSERTS

Screw Machine Products in Plastics and Metals

Speed Machine Works, Inc.
1907 Park Avenue, New York 35
ATwater 9-8563-9

CREATIVE MAN WANTED

We have an opening for a man in our organization, who is capable of creating ideas that will sell in the Advertising Specialty and Calendar field. Experience in this field is not necessary—but it would certainly help. Advancement is limited only by the applicant's ability. A college trained man, 35 or under, preferred. Give age, education, experience, salary requirements and draft status. Write us fully—this is a real opportunity for someone. Reply Box 1026, Modern Plastics.

USED INJECTION MOLDING MACHINES either Reed Prentice or Lester 6-8-10 or 12 inch capacity. Can furnish required releases. Reply Box 1030, Modern Plastics.

WANTED—SALES ENGINEER

By progressive custom molders located in Central New Jersey to represent them in Philadelphia and adjoining territory, on a commission basis. Must have experience in compression and injection molding. Good opportunity for the right man. Give full details and experience in first letter. Reply Box 1027, Modern Plastics.

WANTED
PLASTICS MOLDING PLANT OR EQUIPMENT

Modern plant equipped with 2 or 3 compression molding pressers of 150 to 200 ton capacity with necessary preform machines.
Injection molding equipment also desired.
Please send details to:
Box 162, Equity, 113 W. 42 St., New York 18

WANTED

1 #30 Francis Hydraulic Press Size 30" x 30" dia. of cyl. 14"—Stroke 14" max. ga. pressure p.s.i.—2000 pressure in tons 153; complete with compressor. Reply Box 1028, Modern Plastics.

WANTED

Consultant or Plastic Engineer who can aid us in the application of plastics to our product. We manufacture a universal product which we believe lends itself to the use of plastics.
Reply Box 1029, Modern Plastics

WANTED—SALES REPRESENTATIVES: To sell a new plastic board to molders, fabricators and all consuming industries. We operate our own paper mills. Do our own impregnating. Prefer an individual or organization with knowledge of the plastics industry and ability to find and develop potential users. Write, giving business references, names of accounts handled and territory covered. Reply Box 1025, Modern Plastics.

PLASTIC MANUFACTURERS—Device for diversified printed matter; leaflets, pamphlets, folders, booklets, catalogs, etc. Featuring—all-dimensional, designable, picturesque, display, array, assemblage. Items either single or quantity; singular-or-volume; removable; replaceable. Patent value. Full 20 claims, claimed, issued. Originator, patentee, designer of device, trade mark and sales highlight. Has nothing to sell. Seeks active affiliation. Reply 1023, Modern Plastics.

FOR SALE

1 Worthington 4" x 6" Horizontal Duplex Pump, 100 G.P.M. 250# p.s.i. Complete with 20 H.P. 3 phase 60 cycle 220-240 motor & drive.
1 Worthing Vertical Triplex Pump 4" x 6"—50 G.P.M. at 250# p.s.i.
1 American Marsh 3 Stage direct Connected Centrifugal Pump 25 H.P. 3 ph. 60 cycle 220 Volt Motor—150 G.P.M. 300 Ft. head.
Reply Box 1032, Modern Plastics

WANTED small or medium size plastic injection molding plant with or without tool shop. Advise with full details. Reply Box 1033, Modern Plastics.

MOLDERS NOTICE

Are you molding plastic parts of your own or customers, that can be sold to retail, wholesale or industrial outlets? We offer a national sales organization to assist you or your customers in marketing these products. We can market those tough ones too. Give us a try. Reply Box 994, Modern Plastics.

INDEX TO ADVERTISEMENTS

Accurate Molding Co. 218
Airtronics Mfg. Co. 38
Allied Products Corp. 141
Allis Co., Louis, The 33–34
American Cyanamid Co. 116–117
American Insulator Corp. 151
American Plastics Corp. 199
American Screw Co. 138, 146
Amos Molded Plastics 139
Armour & Co. 198
Atlas Valve Co. 196
Auburn Button Works 144

Bakelite Corp. Inside Back Cover
Baker Castor Oil Co., The 155
Ball & Jewell 200
Bamberger, A. 214
Barco Manufacturing Co. 64
Behr-Manning 16
Binney & Smith Co. 49
Boonton Molding Co. 56
Bridgeport Moulded Products, Inc. 70
Brilhart, Arnold, Ltd. 24
Bristol Co., The 146
Broder, Harry 46, 213
Buffelen Lumber & Mfg. Co. 140
Buttondex Corp. 202

Cambridge Instrument Co., Inc. 190
Carver, Fred S. 212
Catalin Corp. 3
Celanese Celluloid Corp. 9
Central Process Corp. 27
Central Screw Co. 146
Chandler Products Corp. 146
Chemaco Corp. 12
Chicago Molded Products Corp. 133
Chicago Screw Co., The 143
Claremont Waste Mfg. Co. 118
Classified 219–220
Coleman & Co. 212
Columbia Protektosite Co., Inc. 157
Columbian Carbon Co. 49
Connecticut Plastics Products Co. 216
Consolidated Molded Products Corp. 21
Continental Can Co., Inc. 185
Continental Diamond Fibre Co. 52
Continental Screw Co. 146, 211
Corbin Screw Corp., The 146
Cordo Chemical Corp. 25
Cruver Mfg. Co. 63
Curran & Barry 196

Dazor Mfg. Co. 20
Deering Milliken & Co., Inc. 26
Designers for Industry, Inc. 203
Despatch Oven Co. 204
Detroit Macoid Corp. 29
Detroit Mold Engineering Co. 197
Detroit Wax Paper Co. 206
Dillon-Beck Mfg. Co. 196
Disston, Henry & Sons, Inc. 198
DoAll Co., The 169
Dow Chemical Co., The 165
Drakenfeld Co., B. F. 213
du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Div. 65
du Pont de Nemours, E. I., & Co., Inc., Plastics Div. 7
Durez Plastics & Chemicals, Inc. Inside Front Cover
Durite Plastics, Inc. 181

Elmes Engineering Works of American Steel Foundries 59
Engineering Specialties Corp. 204
Erie Engine & Mfg. Co. 201
Exact Weight Scale Co. 190

Farrel-Birmingham Co., Inc. 39
Federal Telephone & Radio Corp. 71
Firestone Industrial Products, Velon Div. 19
Fortney Mfg. Co. 211
Franklin Plastics Div. 217

Gaylord Container Corp. 35
General Electric Co. Back Cover
General Industries Co. 73
General American Transportation Corp. 42
General Screw Mfg. Co. 146
Gering Products, Inc. 205
Girdler Corp., The 53
Goodrich, B. F., Co. 5
Grotelite Co., Inc. 194

Harper Co., H. M., The 146
Hanna Engineering Works 203
Hercules Powder Co. 23
Hodgman Rubber Co. 211
Hydraulic Press Mfg. Co., The 44–45

Ideal Plastics Corp. 206
Illinois Tool Works 177
Industrial & Commercial Trust Ltd. 216
Industrial Hard Chromium Co. 11
Infra-Red Engineers & Designers 206
Irvington Varnish & Insulator Co. 135
Insulation Mfg. Co. 205
International Screw Co. 146

Jones Co., C. Walker 208

Kearney & Trecker Products Corp. 145
Keyes Fibre Co. 77
Kingsley Gold Stamping Machine Co. 213
Koppers Co. 142
Kuhn & Jacob Molding & Tool Co. 209
Kurz-Kasch, Inc. 36
Kux Machine Co. 18

Lamicoid Fabricators, Inc. 207
Lamson & Sessions Co., The 146
Lane, J. H. & Co., Inc. 210
Lea Mfg. Co., The 149
Leominster Tool Co., Inc. 180
Lester-Phoenix, Inc. 153
Lincoln Engineering Co. 184
Lucidol Corp. 210

Mack Molding Co. 207
Mac Rae's Blue Book 209
Makalot Corp. 68
Manufacturers Chemical Corp. 12
Manufacturers Screw Products 146
McAleer Mfg. Co. 66
Mercer-Robinson Co., Inc. 210
Metal Specialty Co., The 60
Metaplast Co. 204
Meyercord Co., The 191
Mica Insulator Co. 163
Michigan Molded Plastics, Inc. 203
Midland Die & Engraving Co. 188
Midwest Molding & Mfg. Co. 198
Milford Rivet & Machine Co. 146, 217
Mills, Elmer E., Corp. 13
Minnesota Mining & Mfg. Co. 201
Minnesota Plastics Corp. 197
Miracle Adhesives Corp. 208
Molded Products Co. 43
Monroe Auto Equipment Co., Plastics Div. 41
Monsanto Chemical Co. 74–75
Mosinee Paper Mills Co. 55
Muehlstein, H. & Co., Inc. 192
Munising Paper Co. 69

National Organ Supply Co. 196
National Plastics Products Co. 218
National Screw & Mfg. Co. 78, 146
Newark Die Co., Inc. 210
New England Screw Co. 146
New York Air Brake Co., The 14
Niacet Chemicals Corp. 209
Nicholson File Co. 48
Nixon Nitration Works, Inc. 15
North American Electric Lamp Co. 208

Northern Industrial Chemical Co. 214
Northwest Syndicate, Inc. 28
Norton Laboratories, Inc. 175

Owens-Corning Fiberglas Corp. 17

Panelyte Div., St. Regis Paper Co. 161
Parker-Kalon Corp. 146, 148
Pawtucket Screw Co. 146
Pheoll Mfg. Co. 146
Phillips Screw Manufacturers 146
Plaskon Division 108–109
Plastex Corp. 147
Plastic Industries Technical Institute 40
Plastic Manufacturers, Inc. 61
Plastimold, Inc. 190
Porter-Cable Machine Co. 189
Precision Plastics Co. 178
Pro-phy-lac-tic Brush Co., Prolon Plastics Div. 10
Pyro Plastics Co., The 192

Racine Tool & Machine Co. 51
Radio Corp. of America 183
Reading Screw Co. 146
Recto Molded Products, Inc. 196
Reed-Prentice Corp. 8
Reichard Coulston 212
Reichhold Chemicals, Inc. 32
Richardson Co., The 6
Riegel Paper Corp. 22
Rogan Brothers 216
Rohm & Haas Co. 31
Royle & Sons, John 176
Russell Burdsall & Ward Bolt & Nut Co. 146

St. Louis Plastic Molding Co. 182
Sav-Way Industries 167
Schauer Machine Co. 216
Scovill Mfg. Co. 146
Shakeproof, Inc. 146
Shaw Insulator Co. 171
Simonds Saw & Steel Co. 62
South Bend Lathe Works 72
Southington Hardware Mfg. Co., The 146
Standard Chemical Co. 202
Standard Molding Corp. 194
Standard Tool Co. 202
Stanley Works, R. L., Carter Division 200
Sterling Plastics Co. 54
Stokes, F. J., Machine Co. 193
Stokes, Jos., Rubber Co. 30
Stricker-Brunhuber Co. 199

Taylor Mfg. Co. 218
Tech-Art Plastics Co. 137
Tennessee Eastman Corp. 115
Thropp, Wm. R. & Sons Co. 200
Timkin Roller Bearing Co. 179, 195
Tinnerman Products, Inc. 131
Trav-ler Karenola Radio & Television Corp. 215

Union Carbide & Carbon Corp. 47
United Electronics Co. 57
United States Rubber Co. 50
United States Testing Co., Inc. 159
Universal Plastics Corp. 58

Varcum Chemical Corp. 187
Victory Mfg. Co. 215
Virginia Lincoln Corp. 67

Washington Veneer Co. 140
Waterbury Companies, Inc. 76
Watertown Mfg. Co., The 186
Watson-Stillman Co., The 37
Westinghouse Electric & Mfg. Co., Micarta Div. 172
White, S. S., Dental Mfg. Co. 213
Wolverine Belt Co. 145
Wood, R. D., Co. 196
Worcester Moulded Plastics Co. 229

MODERN PLASTICS*
PLASTICS*
PLASTICS ENGINEERING*
PLASTICS PRODUCTS*
*REG. U.S. PATENT OFFICE

MODERN PLASTICS
Published by MODERN PLASTICS, INC
122 EAST 42nd ST., NEW YORK 17, N. Y

Dehydrated Can — Courtesy Zenith Associates, Newton, Mass.

Wringing Out Water — HOT or COLD

Dry air must flow steadily from this clear transparent, metal inserted, dehydrator can which we are moulding for Zenith Associates, Newton, Mass. Aircraft all over our fighting fronts depend on it. Under test, when filled with silica gel, this can has to stand 30 pounds per square inch of pressure, a temperature range of −65°F. to 150°F., and severe shock. Even the threads meet rigid specifications.

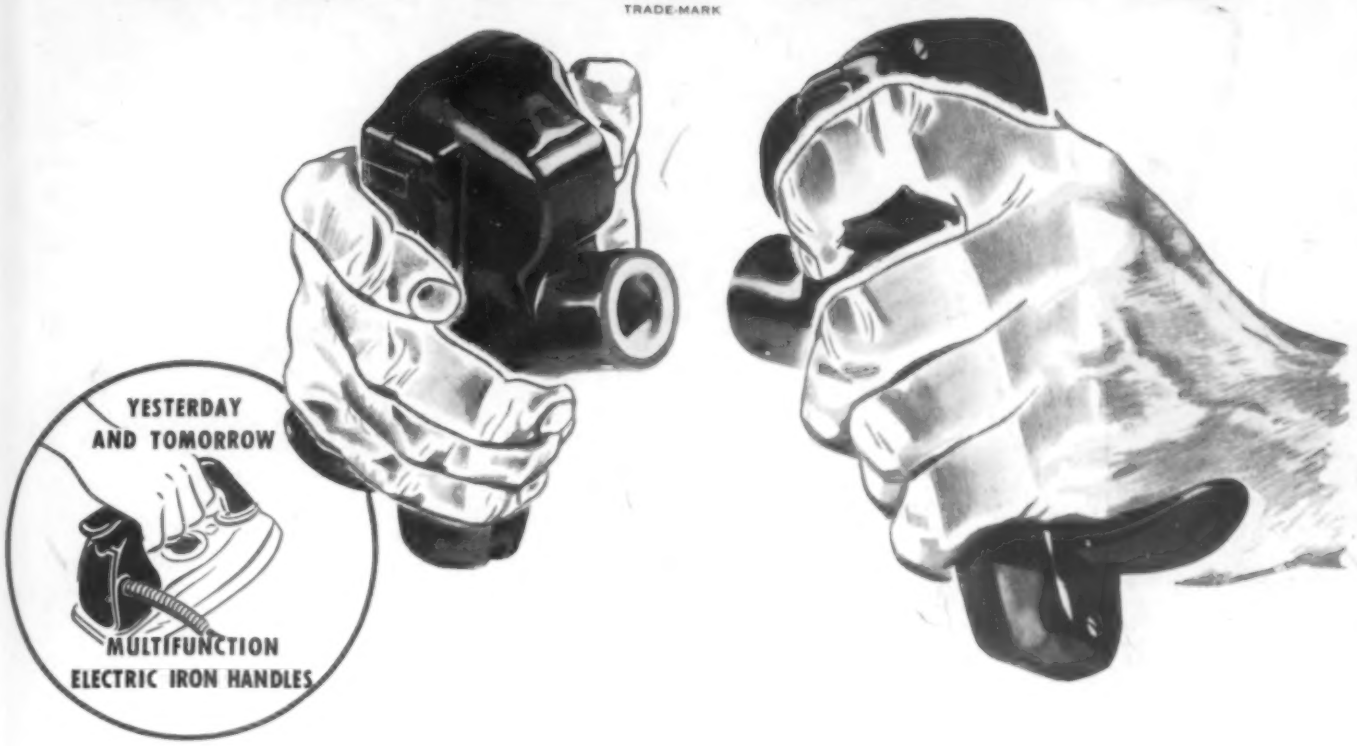
Quality is written all over this plastic application. Quality, knowledge, dependability, speed and volume production, close tolerances, intricate moulds, and painstaking inspection of every piece are our stock in trade — our assets which already have made us a plastics "division" of many of our customer companies. You can have exactly the same confidence in the Trio from your first inquiry about any plastic application.

For Custom Injection Moulding . . . try the Trio

8 GRAFTON STREET WORCESTER 8, MASSACHUSETTS
17 EAST 42nd ST., NEW YORK 17, N. Y.

BAKELITE

TRADE-MARK



Today . . . Two-Fisted Gun Grips

THESE GRIPS, molded from a BAKELITE impact-resistant phenolic plastic, give aircraft gunners instant command of turret rotation, gun firing, and the microphone system. They are miniature switchboards—alive with electrical controls and ready for instant action. But at the same time they are lightweight, tough to withstand impact, and highly dielectric. Temperatures ranging from —70 deg. F. to 180 deg. F. do not affect their form or operation because they are dimensionally stable. Their fine, lustrous, integral finish withstands the roughest handling.

The designing and molding of gun turret control grips closely parallels that of producing peacetime appliances, such as flatiron handles. And both call for the same combination of physical, electrical, and thermal characteristics in the construction material. The right answer for thousands of other products has come from the use of the *right* BAKELITE plastic, plus the coordinated teamwork of designer, molder, and materials supplier.

Our field engineers and development laboratories will gladly work with you on any product that you wish to improve or that is now in the planning stage. Write for Booklet 15M, "Bakelite Molding Plastics."

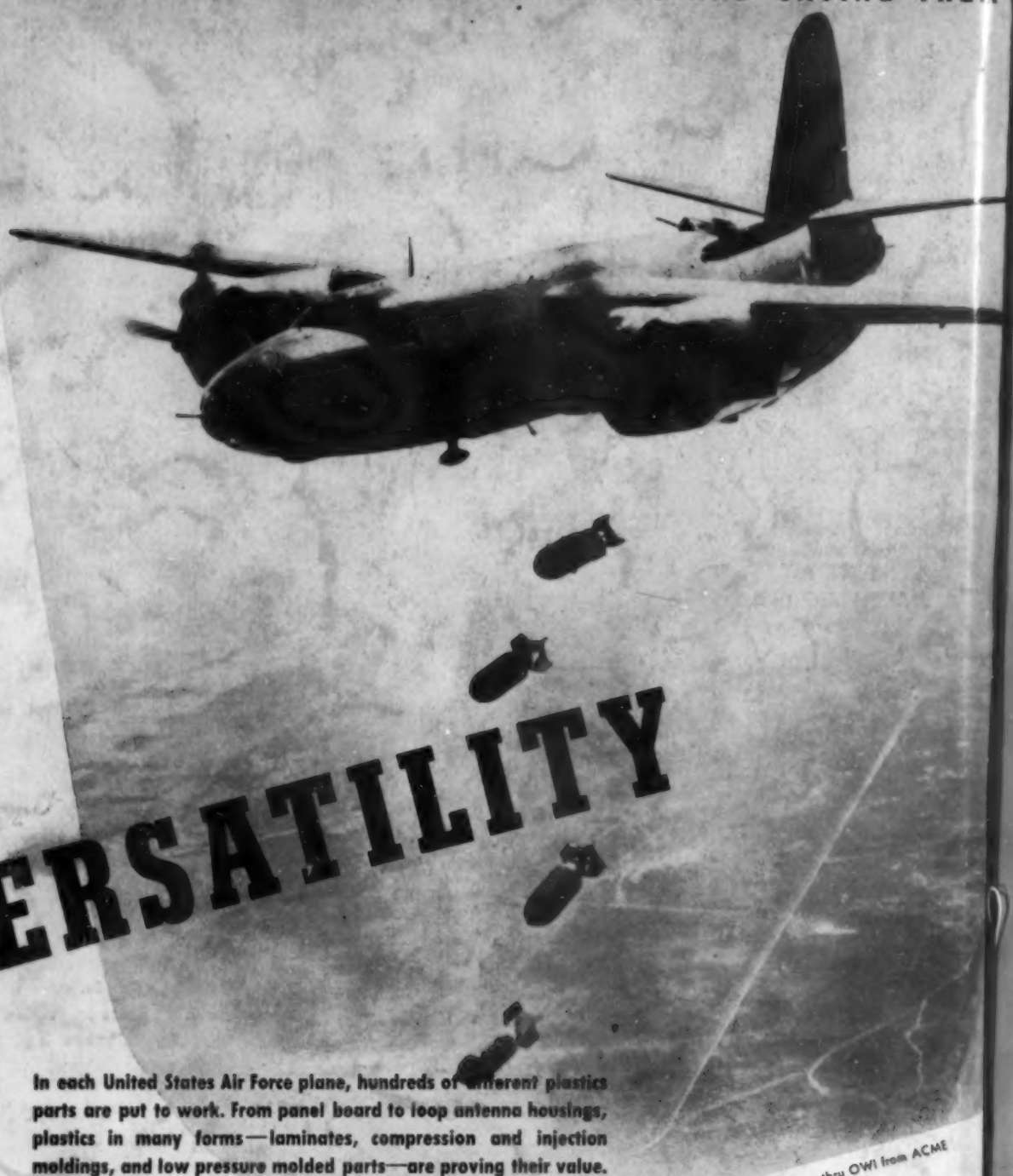
TRADE MARK

BAKELITE CORPORATION, 30 E. 42 St., New York 17
Unit of Union Carbide and Carbon Corporation

UCC

Molding Plastics

NSURE YOUR FUTURE BY BUYING MORE WAR BONDS AND SAVING THEN



VERSATILITY

USAAF Photo thru OWI from ACME

In each United States Air Force plane, hundreds of different plastics parts are put to work. From panel board to loop antenna housings, plastics in many forms—laminates, compression and injection moldings, and low pressure molded parts—are proving their value. The fact that these many parts are put to work in one large structure shows that plastics may fit a great variety of uses.

The versatility of plastics can never be over-estimated. The General Electric Company may recommend one plastics material where great tensile strength is needed, may recommend another plastic for heat resistance and yet another where impact strength is a necessary requirement. Because General Electric molds and fabricates all types of material you can be sure that G-E technicians will recommend the best one for your need.

For help on your problem write Section A-206, One Plastics Avenue, Pittsfield, Mass.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

FIFTY YEARS IN THE PLASTICS INDUSTRY

GENERAL ELECTRIC

PD-206